CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER
DAM & RESERVOIR

MAD RIVER, CONNECTICUT

DESIGN MEMORANDUM NO. 2

SITE GEOLOGY

U.S. Army Engineer Division, New England
Corps of Engineers Waltham, Mass.

MAY 1960

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO. NEDGW

27 May 1960

SUBJECT: Mad River Dam and Reservoir, Mad River, Connecticut River Basin, Connecticut, Design Memorandum No. 2 - Site Geology

TO: Chief of Engineers
Department of the Army
Washington, D. C.
ATTENTION: ENGCW-E

There are submitted herewith for review and approval 10 copies of Design Memorandum No. 2 - Site Geology for the Mad River Dam and Reservoir, Mad River, Connecticut River Basin, in accordance with EM 1110-2-1150.

FOR THE DIVISION ENGINEER:

for J. C. Dingwall
JOHN WM. LESLIE
Chief, Engineering Division

Incl
Des Memo No. 2 -
Site Geology
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MAD RIVER DAM AND RESERVOIR

MAD RIVER

CONNECTICUT RIVER BASIN

CONNECTICUT

DESIGN MEMORANDUM NO. 2

SITE GEOLOGY

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FLOOD CONTROL PROJECT

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* Initial submission in draft to secure approval of spillway design flood, and top of dam elevation.

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another method of ensuring that the internal hookwall valve is

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
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424 TRAPELO ROAD
WALTHAM 54, MASSACHUSETTS

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DESIGN MEMORANDUM NO. 2

SITE GEOLOGY

MAY 1960

A. GENERAL GEOLOGY AND TOPOGRAPHY

1. The Mad River Valley is located in the Western Highlands of Connecticut, a broad upland of moderate relief which is underlain by crystalline rocks, gneiss, schist and granitic rocks, generally considered Paleozoic in age. The rocks have been closely and intricately folded with the folds trending generally north-south.

2. The region has been considerably modified by glaciation. In the relatively narrow valleys glacial outwash forms broad, flat plains locally along a few reaches of the larger streams but steep gradients make many falls and rapids where the streams have encountered bedrock or boulder concentrations in the valley bottoms.

Bedrock outcrops extensively through the generally thin till overburden which blankets the boulder-strewn, steep flanks and the crests of the rugged hills and ridges.

B. LOCATION AND DESCRIPTION OF SITE

3. The Mad River Dam site is located on the Mad River approximately 0.3 miles upstream from the westerly city limits of Winsted, Connecticut, and 2.3 miles above the confluence of the Mad River and the Still River. Federal Highway Route 44 runs along the left abutment of the dam site in a deep rock cut approximately 50 feet above the river.

4. As shown on General Plan and Reservoir Map, Plate 2-1, the project intended mainly for flood control on the presently essentially uncontrolled Mad River, consists of an earth fill dam with a maximum height of 178 feet located in the main river valley; a long earth fill dike to close two saddles behind the left abutment of the dam; and a chute spillway located on the left abutment between the dam and dike. The ungated outlet conduit located partially on an abandoned railroad right of way on the right abutment has a weir with a crest elevation of 872 m.s.l. to maintain a conservation pool approximately 30 feet above the bottom of the present stream at the dam.

5. At the site the river flows in a deep, narrow, steep-sided valley with heavily wooded slopes. The right abutment rises abruptly from the stream's edge to the abandoned railroad right-of-way approximately 40 feet above the channel bottom and then continues upward very steeply to heights far above the top of the dam. The left abutment is a low ridge which rises steeply from the river to an elevation of about the top of the dam. The spillway is located on the ridge at

the left end of the dam, and from the spillway a dike extends approximately 1000 feet upstream along the crest of the ridge and then trends northly to close a wide saddle between the ridge and the high hills on the north side of the Mad River Valley.

C. SURFICIAL AND SUBSURFACE INVESTIGATIONS

6. Previous Investigations. - An interim report on Review of Survey, Mad River Dam and Reservoir was published in June 1956. The results of geological reconnaissance and subsurface investigations consisting of eight borings were presented in the report in Appendix A - Geology.

7. Current Investigations. - When work was resumed on the Mad River site in 1959, the previous report and all data were reviewed and re-evaluated. Detailed geological reconnaissance was made for development of a subsurface exploration plan of design scope. Foundation exploration by borings was confined initially to the dike site because of the thickness of the overburden in contrast to the dam site where rock is frequently exposed or generally occurs at shallow depths.

8. Initially 13 borings were completed in the dike area to obtain foundation information. It was subsequently necessary to complete 8 additional borings in the dike area to investigate the feasibility of obtaining an impervious cut-off to rock along the upstream side of the dike and the necessity for positive seepage control along the downstream toe of the embankment.

9. On the left abutment at the dam site 6 shallow trenches and 4 borings were completed to investigate the thickness and character of the overburden and to obtain data regarding the condition of the rock. The right abutment of the dam was explored initially by one boring and 7 pits of which 5 pits failed to establish the rock surface. Therefore, 2 borings were made on the abutment slope to definitely establish the surface and the condition of the bedrock. One boring was also made to determine the inner condition of the rock spine between the old railroad cut and the river so that the necessity for grouting or the removal of the rock could be evaluated.

10. Four trenches in the old railroad cut and six borings completed to date were located specifically to furnish data for outlet conduit layout and design. These explorations, however, also contributed information regarding the general overburden and bedrock conditions on the right abutment.

11. During the initial stages of exploration, primary consideration was given to development of layouts and design for a side channel spillway. Four borings and 9 shallow pits or trenches were completed in the area of the side channel weir and discharge channel. Three of the borings were located on and adjacent to the weir and the bedrock was core-drilled to depths corresponding to the bottom elevation of the deep side channel excavation. Subsequent studies for a chute type spillway utilized all information from the above explorations but because of the large increase in width of the chute discharge channel as well as change in alignment, it was necessary to excavate 11 additional

shallow pits and trenches to determine depth to bedrock particularly along the left side of the discharge channel.

12. Foundation exploration is still in progress. Plan of Foundation Exploration, Plates 2-2 and 2-3, show the location of explorations completed or definitely located in the field to date. It is expected, however, that a few additional borings and pits may be required to finalize design assumptions at concrete structure sites or other critical locations.

13. All borings were continuously drive-sampled in overburden and, where encountered, the bedrock was diamond drill cored, using maximum recovery type core barrels, generally to a minimum penetration of 20 feet in bedrock. Hydraulic pressure tests in bedrock were conducted in 3 borings in the vicinity of the spillway weir, in 4 borings along the conduit alignment, in 1 boring on the left abutment of the dam and in 2 borings at the dike site. Detailed classifications and descriptions of materials encountered in all explorations are shown in Records of Foundation Exploration, Plates 2-7 to 2-11.

14. Reconnaissance early in the study of the project indicated that locating nearby sources of suitable borrow materials for construction would be a major problem. Deposits of glacial till are wide-spread but the highly irregular bedrock surface is exposed in such numerous and extensive areas that till deposits of workable thickness are relatively rare. Initial sampling also indicated that the regional till was characteristically a sandy type till rather than the more relatively impervious, silty or clayey till which occurs in many other areas of New England. Exploration was required,

therefore, not only to locate the thicker, more economically workable deposits but also to delineate the extent of the siltier, more impervious phases of the till. The location of deposits of pervious materials was also difficult because such deposits are unusually scarce in the Mad River Valley and the extensive deposits of pervious materials in the Still River valley at Winsted are already largely occupied as building sites for the city or have been exhausted by many years of borrowing to provide for local construction needs. Although it is believed that a sufficient quantity of relatively impervious material has already been located, sources of pervious materials in adequate quantity to meet requirements have not been finalized. Exploration for pervious materials, including gravel bedding, is continuing and trenches in selected areas of both the relatively impervious and pervious materials will be required to obtain large samples of the respective materials for laboratory tests. Inasmuch as the borrow explorations are not yet complete, records of the borrow explorations showing detailed classifications and descriptions of the materials are not included in this memorandum but will be presented with more detailed plans and description of the areas in subsequent memoranda.

D. SURFICIAL GEOLOGY

15. At the dam site the Mad River is confined in a deep, narrow, steep-sided valley with the river flowing on or close to the bedrock surface along the left side of the stream and with bedrock exposed or occurring at generally shallow depths beneath a thin, bouldery till blanket on both abutments. Bedrock at the site is

mainly a series of closely folded, crumpled and highly jointed metamorphic rocks intruded locally by large masses of granitic rocks. As shown in photographs of typical bedrock exposed in the highway cut at the site, Figure 1, both the rock type and structure vary widely within short distances. In spite of the local variations, however, there is a very general north-south trend to the bedrock structural lineation at the site. On the left abutment, in the spillway area, and along most of the spillway discharge channel, bedrock outcrops in numerous and extensive, broken abrupt ribs and knobs between which are boulder-strewn, till-filled troughs. Much of the spillway discharge channel lies within a natural broad gully in the rock which is occupied by a small intermittent stream. On the right abutment the bouldery till blanket, although generally thin, is more continuous than that on the left abutment, and bedrock is exposed within the dam area on the abutment only in and adjacent to the rock cut for the abandoned railroad. On the ridge immediately upstream from the spillway area there are a few bedrock outcrops but within the dike foundation area the rock is buried by till. In the wide, flat saddle closed by the dike, run-off from the adjacent slopes tends to remain in local undrained depressions to create a high water table and keep the area wet during a large part of the year. On the far northern abutment of the dike the ground surface is thickly strewn with boulders probably derived in part from the bedrock outcrops which occur on the slope above the dike area.

TYPICAL BEDROCK EXPOSED IN HIGHWAY CUT

MAD RIVER DAM SITE

FIGURE I

E. FOUNDATION CONDITIONS

16. Overburden. - The overburden throughout the entire area including dam, dike and spillway sites and spillway discharge channel consists of loose to fairly compact, modified, relatively semi-pervious to semi-impervious glacial till. The till is characteristically variable ranging from silty, gravelly sand to silty, sandy gravel. Cobbles and boulders occur commonly disseminated through the till and in local concentrations both within the till and on the ground surface. In local depressions in limited areas, superficial deposits of silt or silty sand have accumulated overlying the till. At the dike site where the till deposits are moderately to quite thick, there are a few irregular pods or lenses of poorly sorted silty sand and silty, sandy gravel. These deposits are thin, discontinuous and generally constitute only minor phasal differences in the till.

17. On the right abutment of the dam, in the spillway area, and throughout most of the spillway discharge channel, the overburden is generally less than 5 feet in thickness. Because of the irregularity of the bedrock surface, however, local pockets or troughs may be encountered where the overburden may be up to 10 feet thick. At the upper end of the spillway discharge channel in the vicinity of test trenches, FTT-17, FTT-18 and FTT-19 the overburden is approximately 10 feet thick. As may be seen on Geologic Section, Plate 2-5, the spillway discharge channel will be cut through the thick fill for Highway Route 44. Below the highway the left abutment is thickly strewn with waste rock from the highway excavations.

18. Similarly, the right abutment below the old railroad cut is blanketed with waste rock from the old excavations and an old, partly failed, masonry wall extends along the right side of the channel downstream from the centerline of dam where the old railroad rests partly on fill. Above the railroad the overburden on the right abutment ranges from 5 to about 12 feet in thickness. Although no deep gorge occurs under or adjacent to the stream in the valley bottom, local troughs or pockets in the rock, possibly up to 15 feet in depth, may be encountered. Topsoil over the entire site is generally about 1 foot in thickness but in local areas on steep slopes may be less than 1 foot and in flat areas where forest debris has accumulated, topsoil and organic material reach thicknesses up to approximately 3 feet.

19. Bedrock - Bedrock throughout the entire site area consists mainly of gneiss with many schist lenses and thin stringers, dikes and large masses of granitic rocks. The gneiss and schist are gradational into each other in many areas. The schist is commonly the quartz-biotite variety but hornblende schist also occurs locally. The gneiss ranges from thinly foliated, fine-grained to very coarse-grained with thick, felted biotite folia inclosing lenticular pods and knots of quartz and feldspar. The granitic rocks consist of fine-grained, light gray granite and pink, coarse-grained pegmatite.

20. The general trend of the rock structure is roughly north-south but as may be seen from strike and dip symbols on Plan of Exploration, Plate 2-2, the orientation of the rock structure is highly variable within limited areas. The dip of the foliated rocks is generally steep to vertical. The gneiss, schist and granitic rocks

are all generally closely jointed with only minor massive phases. There are apparently no predominant joint systems which have consistent direction or attitude over considerable areas. Several small shear zones can be seen in the exposed face of the deep cut on Route 44.

21. Few, or very limited, areas were encountered where the rock as a whole was weathered to more than nominal depths below the rock surface, and the rocks are all relatively hard and fresh. Throughout the entire site, however, weathering has occurred to considerable depths along numerous closely spaced joints and foliation planes. In borings FD-22, FD-23 and FD-24 which were drilled in the vicinity of the spillway weir, the most severe weathering along joints and foliation planes is confined to the upper 10 feet below the rock surface and minor weathering is evident along seams to the full depth of the borings in rock which was 50 feet at FD-22 and FD-23 and 42 feet at FD-24. The condition noted in the above borings is considered generally typical for the site with mud-filled, badly weathered seams confined generally to the upper 10 feet of the rock. In a few borings, however, badly weathered seams were noted at depths up to 20 feet below the rock surface, and it must be expected that occasional badly weathered open joints or foliation planes extend to even greater depths. It must also be noted that because of the complex lithology and variations in structure, together with the very irregular, ridge and trough character of the rock surface determination of the actual sound rock surface from borings may not be conclusive and some of the mud-filled seams and weathered zones

encountered may indicate continuous, nested boulders or detached rock blocks rather than actual bedrock in place. This condition is believed most probable in some areas of the dike foundation but wherever it may occur at the site, it could only be revealed by very extensive trenching or by inspection during construction.

22. Water losses in hydraulic pressure tests conducted in rock in selected borings were generally very small except at FD-24 in the spillway area where a loss of 15 gpm at 10 psi was encountered in the zone between 5 and 10 feet below the rock surface and in some of the borings along the conduit alignment where losses up to 17 gpm at 0 psi were encountered. However, loss of drilling water in rock in many of the borings and the occurrence of weathered seams in the rock cores indicates that significant seepage can occur through fissures in these rocks.

F. SUBSURFACE WATER

23. At the dam site the level of subsurface water is generally well below the rock surface except where local troughs in the rock surface provide traps to hold temporary pools during wet seasons. Because of the proximity of the rock to the ground surface, the gulley in which the spillway discharge channel is partly located also contains an intermittent stream. At the dike site subsurface water occurs near the ground surface in the bottom of the wide saddle but is generally at depths of 10 to 20 feet in the vicinity of FD-20 and FD-21. In the northern abutment of the dike the subsurface water occurs below the top of rock.

G. RESERVOIR LEAKAGE

24. Upstream from the dam and dike the sides of the reservoir are bedrock ridges with crest elevations far above reservoir levels. The lower slopes of the ridges are largely blanketed with till. There is no possibility, therefore, of leakage through the sides of the reservoir.

H. CONSTRUCTION MATERIALS

25. The actual designs for embankments have not been finalized, however, it is presently contemplated that the embankment for the dam will consist generally of an internally zoned section composed of glacial till with the relatively more impervious till on the upstream side of the embankment. A large rock fill section will extend along the downstream toe and the cofferdam composed of rock fill with a borrowed random fill upstream blanket will be located at the upstream toe. A pervious drainage blanket will rest on rock under part of the downstream till section and will extend to the rock fill toe. Tentatively it is considered that a pervious wick may be incorporated in the downstream till section. The dike will be composed of an essentially homogeneous section consisting of glacial till with a downstream pervious drainage blanket extending into a foundation drainage trench along the downstream toe. A pervious wick is also tentatively being considered in the downstream till section of the dike. Both dam and dike will have upstream and downstream rock fill slope protection suitably backed by gravel bedding.

26. Sources of the various types of materials necessary for construction are described in the following paragraphs. In some of these areas explorations are currently in progress.

27. Impervious and Random Materials.- Area A located adjacent to the spillway and immediately downstream from the dike area as shown on General Plan and Reservoir Map, Plate 2-1, was explored by 10 borings and 3 trenches. The area contains a large quantity of till. The till is characteristically variable but consists generally of relatively impervious to semi-impervious, gravelly, silty sand with numerous cobbles and boulders. Because of the irregularity of the underlying bedrock surface, the thickness of the deposit is variable ranging generally from 10 to 25 feet, except in a small area where bedrock is exposed at the ground surface. Much of the northern part of the area is flat, poorly drained and swampy in the lower parts so that control of water may be an important problem in borrow operations in the area.

28. Area D located as shown on General Plan and Reservoir Map, Plate 2-1, along the Rattle Valley road and in the saddle between Crystal Lake and the Mad River Valley, was explored initially by 9 borings to locate a source of impervious material. Borings along the upstream side of the area adjacent to the road showed variably modified till to considerable depths underlain by relatively impervious, silty till. Although borings on the downstream side of the area encountered rock at depths of 8 to 35 feet, the silty till was encountered at generally shallower depths under the modified till. In an effort to delineate the areas where the more impervious till occurs at relatively shallow depths, 3 additional borings were completed. Exploratory trenches will be excavated at locations where the silty till can be reached at the shallowest depths to permit visual inspection of the material in place and to obtain bulk samples for tests.

29. Area B located at the upstream end of the flood control reservoir as shown on General Plan and Reservoir Map, Plate 2-1, was explored by 6 borings. Although some pervious materials consisting generally of gravelly sand occur in the area, the pervious deposits are thin, scattered and variable and are underlain by random type, relatively semi-impervious to semi-pervious, silty, gravelly sand and silty, sandy gravel. Bedrock was encountered in the area at variable but generally shallow depths ranging from 1 foot to 23 feet.

30. Area C as shown on General Plan and Reservoir Map, Plate 2-1, is located in the reservoir area adjacent to Old Norfolk Road and the bridge over the Mad River on Highway Route 44. Five borings completed in the area showed that a limited quantity of pervious, stratified, gravelly sand and sandy gravel occurs in the low terrace adjacent to the highway. In the channel and the low valley bottom along the river, there are recent, thin, alluvial flood deposits, mostly gravel, cobbles and boulders. Both the pervious and alluvial deposits are underlain by random type, modified till consisting of silty, gravelly sand, and silty, sandy gravel. Bedrock outcrops in the river and along the bank near the highway bridge and was encountered in the explorations at depths ranging from 9 to 26 feet in the area.

31. Pervious and Gravel Bedding Materials.- In Area E located along the upper Mad River Valley at Grantville, approximately 4 miles west of the dam site, relatively pervious materials consisting mostly of gravelly sand and sandy gravel occur in relatively thin but extensive deposits along the south side of the valley. The materials are underlain

by the very irregular bedrock or till surface. East of the road which runs south from Grantville, the deposits have been worked for many years and bedrock is exposed on the floor of some of the old pits. West of the road the deposits have never been opened up and explorations consisting of borings and backhoe excavated trenches were completed to investigate the character and extent of materials which might be usable. Although the borings indicated a rather borderline material with fines ranging generally between 6 and 12 percent, inspection of the material recently exposed in test trenches shows large masses of silty material disseminated between the local pockets of more pervious material. Most of the area is at or close to river level so that dragline operations below water would be required but this method of excavation is not expected to significantly reduce the amount of fines.

32. At Riverton on the West Branch of the Farmington River, a haul distance of approximately 6 miles from the site, gravel occurs in very extensive deposits consisting of cobble and gravel bars and low terraces in and along the river between the Farmington River bridge at Riverton and the northern boundary of the American Legion and Peoples State Parks. Although exploration of the area has not been initiated, it is believed that these deposits may provide a source of gravel for bedding. The quantity of material available is far in excess of the requirements for the Mad River dam.

33. Downstream from the state parks on the West Branch of the Farmington River between Pleasant Valley and the breached dam at the north side of New Hartford, a haul distance from the site of

about 8 miles, there are also very large and extensive deposits of gravel and gravelly sand in and adjacent to the river. In this area, however, the deposits appear to be generally finer than at Riverton and more exploration would be required to select areas with a minimum silt or fine sand cover. In addition to these undeveloped sources along the river, there are also commercial pits and in some cases processing plants at several localities within 15 miles of the site.

34. Rock Fill.- Rock from required excavations will be suitable for use in rock fills and slope protection. The quantity of rock presently estimated to be available from required excavations will not be adequate, however, for construction of rock fill sections and slope protection. Additional rock may be obtained from boulders in required stripping at the site and from quarries opened up in nearby areas where rock is outcropping or known to occur at shallow depths.

35. Concrete Aggregates.- It is estimated that approximately 4900 cubic yards of concrete will be required for construction of the chute type spillway weir, walls, intake structure and conduit. Aggregate studies made in conjunction with other flood control projects in this area indicate that satisfactory materials are available from several commercial sources within 25 mile haul distance. Complete data on testing of concrete aggregates is contained in Design Memorandum No. 3, Concrete Materials.

I. RECOMMENDATIONS AND CONCLUSIONS

36. Geologic conditions are generally favorable and all geologic factors are being fully considered in the development of the designs

for proposed construction. The dam site is suitable for concrete construction, however, the rolled earth fill type of embankment has been determined more economical.

37. The bedrock is relatively strong and hard and reasonably durable. The bearing capacity of the bedrock is well in excess of any proposed structure loadings.

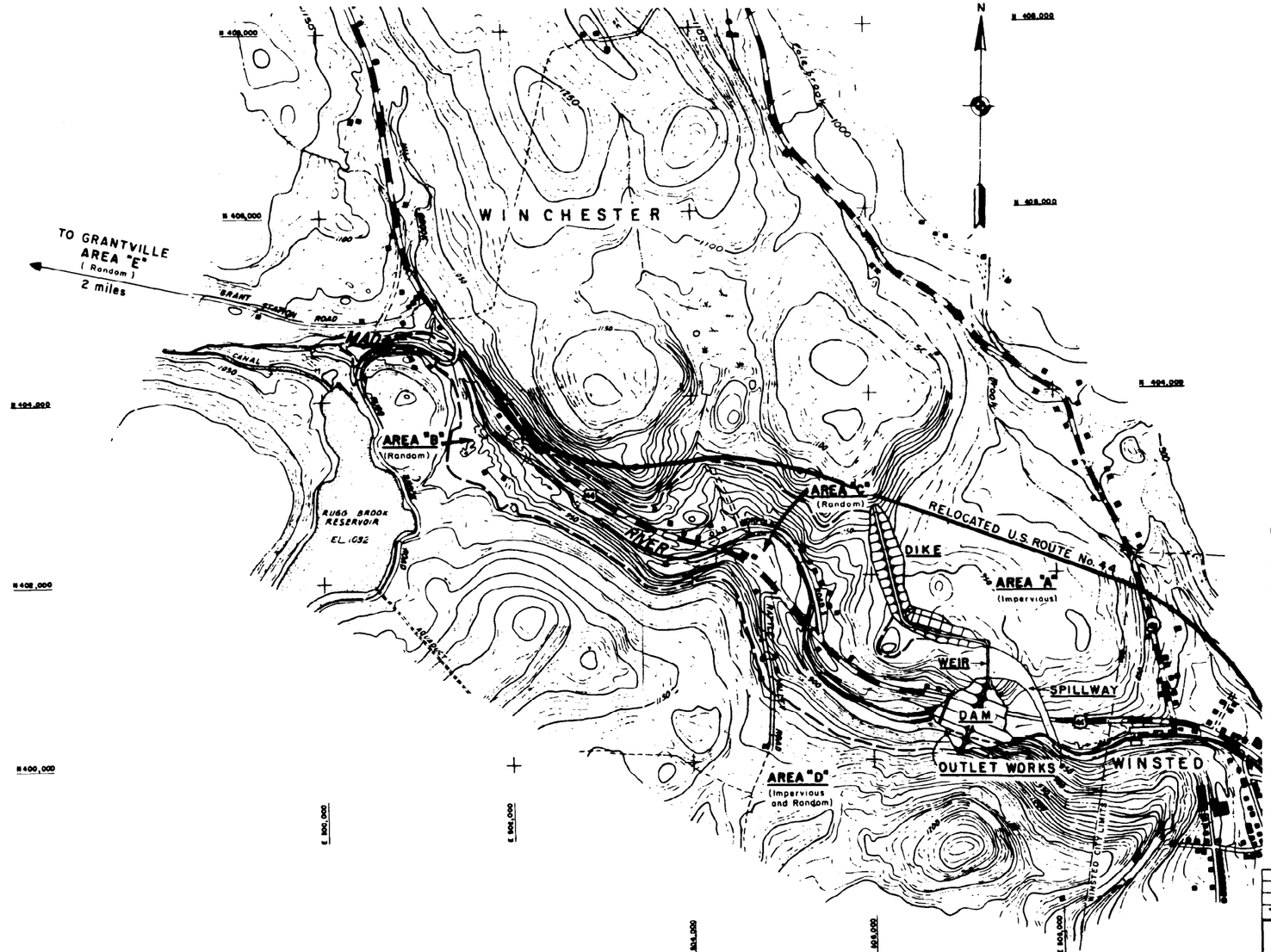
38. Weathering in the upper zones of the bedrock along open foliation planes and joints, together with the wide range of attitude of bedrock structure in relation to alignment of construction features, make control of seepage in and along the weathered zone of special importance at this site. Grout curtains will be required at all concrete structures including the spillway weir and walls and the outlet conduit. The necessity for grouting beneath the dam embankment has not been fully determined at this time because it will depend largely on the final design of the embankment and on conditions disclosed at the time of construction. The natural wide variation in the character of the till overburden filling the hollows and troughs in the very irregular, knobby, ridge and trough bedrock surface also presents a seepage problem but, if desired, impervious cutoff to bedrock is available at the dam site at generally shallow to moderate depths. The nested boulder or weathered bedrock condition indicated by explorations in the wide saddle and north abutment of the dike makes cutoff to bedrock appear impractical since it would be necessary to excavate the rock blocks or weathered rock below the water table in much of the area and to depths of as much as 18 feet.

39. Maximum depth of excavations in bedrock will not be over 40 feet and design slopes of 4 on 1 are recommended. Because of open, close jointing and foliation in the upper zones of the rock, however, natural breakage of the rock and safety considerations may result in flattening the upper slopes of the excavations. Natural joint and cleavage planes in the rock will be followed in excavations where such planes approximate design slopes. Local fallouts beyond excavation lines must be expected where variation in attitude of rock structure produces unsupported joint blocks. Provision will be made in specifications for rock bolts and steel mesh as may be necessary, and the overburden will be cleaned off to leave a 10 foot berm along the top of rock cuts. Line drilling and close drilling will be required for control of rock breakage at concrete structure locations and careful approach to final slopes and grades which will be in contact with concrete will also be required. In excavations for the spillway discharge channel, natural deep troughs in the irregular rock surface or overbreak on the side slopes caused by weathered rock or fallouts may result in loss of free-board so that low concrete or riprap walls may be required locally.

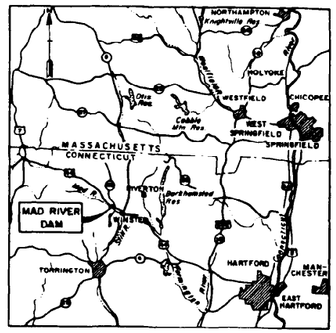
40. Rock from required excavations or from nearby quarrying will be suitable for rock fill and slope protection. Gradation and fragment shape of the excavated rock should be generally acceptable. Adequate sources of borrow materials for construction of the embankments have been or will be located before embankment designs are finalized. No.

special difficulties are expected in excavating the till in the impervious and random borrow areas, Area A and Area D. Because of a high level of subsurface water and the general low relief, however, water may be a problem in Area A.

CORPS OF ENGINEERS — U.S. ARMY



RESERVOIR PLAN
SCALE IN FEET
0 500' 1000' 2000'



VICINITY MAP
SCALE IN MILES
0 5 10

LEGEND

- Reservoir at spillway crest, El. 983
- Relocated highway
- State and Federal highways
- Existing gravel roads
- Surfaced Town roads
- Winsted Town Limit

NOTES

Elevations refer to Mean Sea Level Datum.

Contour interval is 10 feet.

Plane coordinates refer to Connecticut State Lambert Grid System.

Topography is based on U.S.G.S. and Army Map Service Maps.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY M.A.V.	DR. BY M.S.	CK. BY R.C.G.

CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER DAM

GENERAL PLAN AND RESERVOIR MAP

MAD RIVER CONNECTICUT

SUBMITTED: W.C. Hall, Jr. — WATER CONTROL SECTION
PROJECT ENGINEER: Andrew W. Hughes
APPROVAL RECOMMENDED: R.C. Lewis — CHIEF, PGN & WATER CONTROL BRANCH
APPROVAL RECOMMENDED — CHIEF, PLANNING BRANCH
APPROVED — CHIEF, ENGINEERING DIVISION

DATE: MAY 1960

SCALE AS SHOWN | SPEC. NO. CIV ENG - 19-018- | DRAWING NUMBER | SHEET #

PLATE 2-1

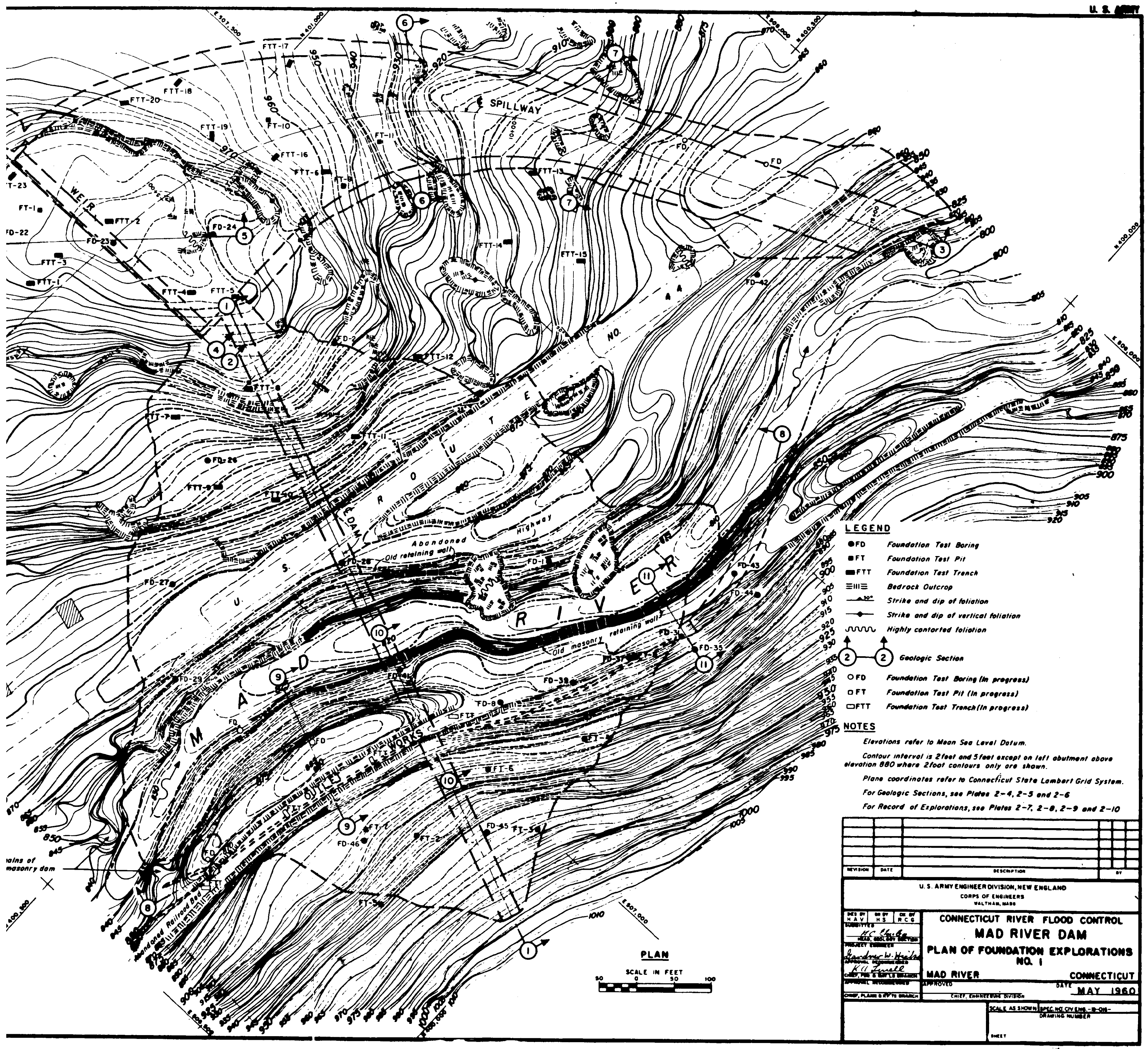
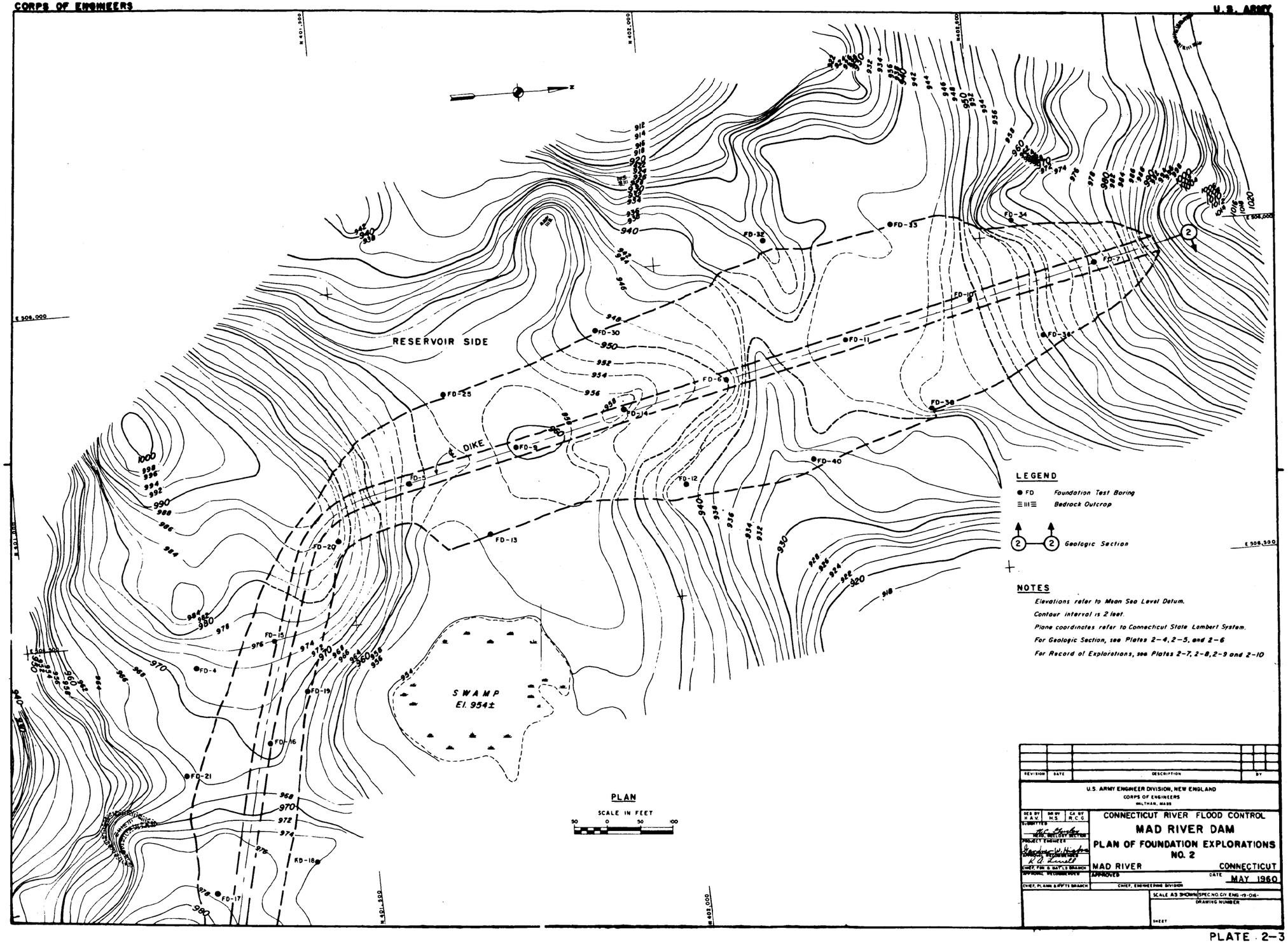

U. S. ARMY
SPILLWAY
WEIR
U. S. ROUTE NO. 44
MAD RIVER
Abandoned Highway
Old retaining wall
Old masonry retaining wall
OUTLET WORKS
Abandoned Railroad Bed
Remains of masonry dam
PLAN
SCALE IN FEET
50 0 50 100
LEGEND
FD Foundation Test Boring
FT Foundation Test Pit
FTT Foundation Test Trench
Bedrock Outcrop
30° Strike and dip of foliation
Strike and dip of vertical foliation
Highly contorted foliation
2 — 2 Geologic Section
FD Foundation Test Boring (In progress)
FT Foundation Test Pit (In progress)
FTT Foundation Test Trench (In progress)
NOTES
Elevations refer to Mean Sea Level Datum.
Contour interval is 2 feet and 5 feet except on left abutment above elevation 880 where 2 foot contours only are shown.
Plane coordinates refer to Connecticut State Lambert Grid System.
For Geologic Sections, see Plates 2-4, 2-5 and 2-6
For Record of Explorations, see Plates 2-7, 2-8, 2-9 and 2-10
REVISION
DATE
DESCRIPTION
BY
U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
DES BY H A V
DR BY H S
CK BY R C G
HEAD, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
APPROVAL RECOMMENDED
CHIEF, PLANS & SPEC'S BRANCH
CONNECTICUT RIVER FLOOD CONTROL
MAD RIVER DAM
PLAN OF FOUNDATION EXPLORATIONS
NO. 1
MAD RIVER
CONNECTICUT
APPROVED
CHIEF, ENGINEERING DIVISION
DATE MAY 1960
SCALE AS SHOWN
DRAWING NUMBER
SHEET

PLATE 2-2

CORPS OF ENGINEERS

U.S. ARMY



PLAN

SCALE IN FEET

50 0 50 100

LEGEND

● FD *Foundation Test Boring*

≡III≡ *Bedrock Outcrop*

2 — 2 *Geologic Section*

NOTES

Elevations refer to Mean Sea Level Datum.

Contour interval is 2 feet.

Plane coordinates refer to Connecticut State Lambert System.

For Geologic Section, see Plates 2-4, 2-5, and 2-6

For Record of Explorations, see Plates 2-7, 2-8, 2-9 and 2-10

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

DES BY H.A.V.	DR BY M.S.	CA BY R.C.G.

SUBMITTED
CHIEF, GEOLOGY SECTION

PROJECT ENGINEER

RECOMMENDED
CHIEF, FDR & DAM'S BRANCH

APPROVAL RECOMMENDED
CHIEF, PLANS & APPTS BRANCH

CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER DAM

PLAN OF FOUNDATION EXPLORATIONS NO. 2

MAD RIVER CONNECTICUT

APPROVED
CHIEF, ENGINEERING DIVISION

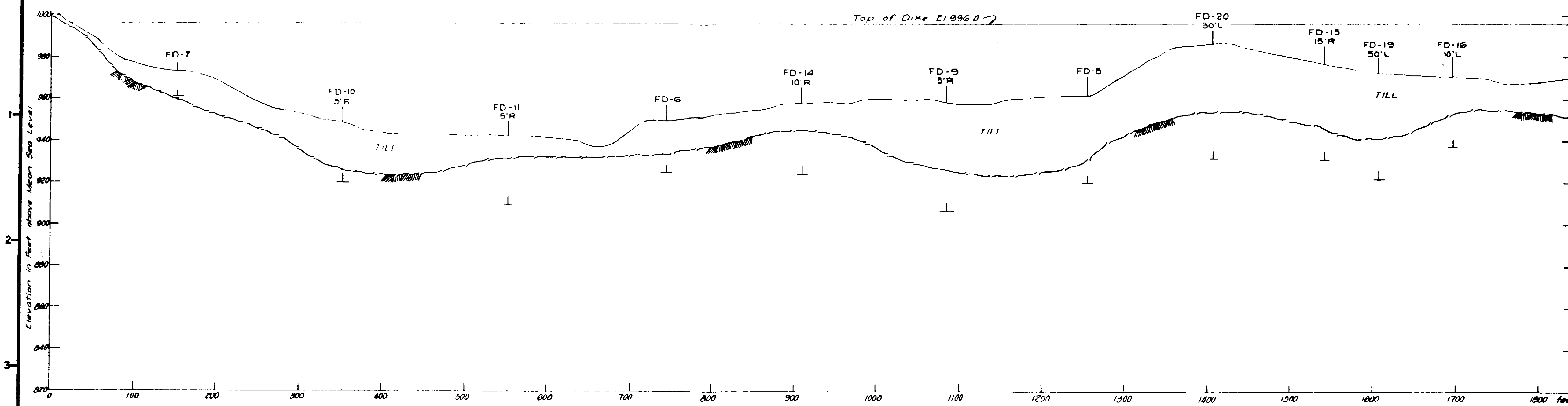
DATE MAY 1960

SCALE AS SHOWN SPEC NO CIV ENG-19-016-
DRAWING NUMBER

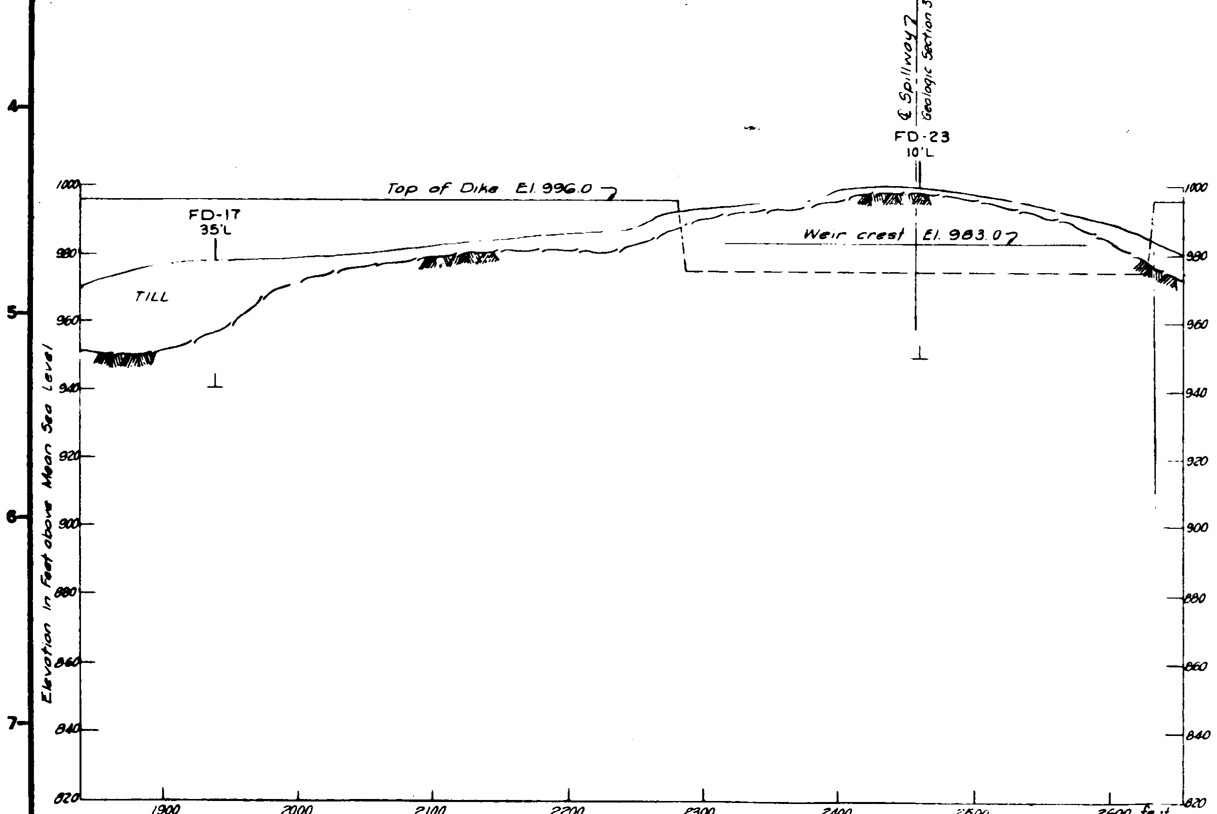
SHEET

PLATE 2-3

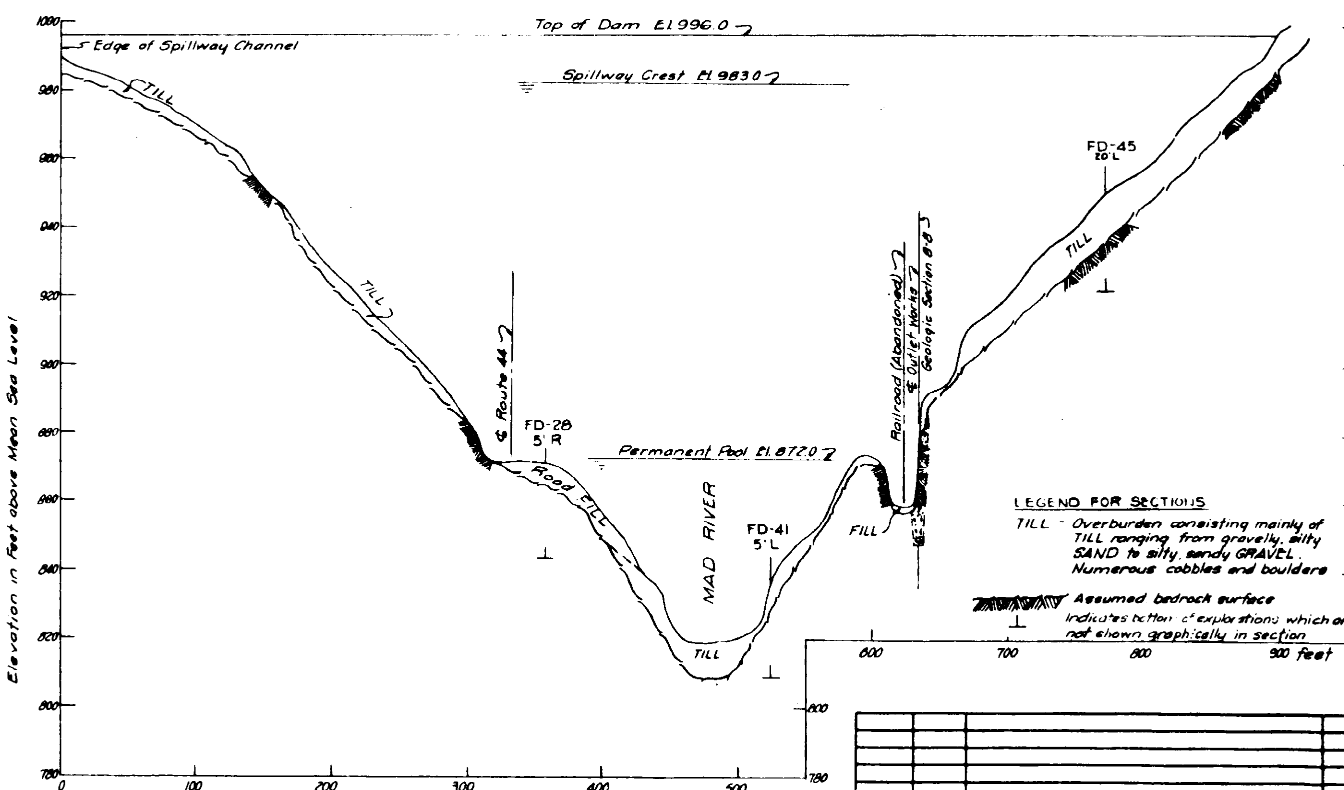
CORPS OF ENGINEERS | U. S. ARMY



GEOLOGIC SECTION 2-2, ALONG ℄ OF DIKE
(LOOKING DOWNSTREAM)



GEOLOGIC SECTION 2-2, ALONG ℄ OF DIKE (Continued)
(LOOKING DOWNSTREAM)



GEOLOGIC SECTION 1-1, ALONG ℄ OF DAM
(LOOKING DOWNSTREAM)

LEGEND FOR SECTIONS

TILL - Overburden consisting mainly of TILL ranging from gravelly, silty SAND to silty, sandy GRAVEL. Numerous cobbles and boulders

Assumed bedrock surface

⊥ Indicates bottom of explorations which are not shown graphically in section

NOTES

For Record of Foundation Explorations, see Plates 2-7, 2-8, 2-9 and 2-10.

For Location of Geologic Sections, see Plates 2-2 and 2-3

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.A.V. | DR. BY C.B. | CK. BY R.C.S.

SUBMITTED: H.C. Hinkley, HEAD, GEOLOGY SECTION

PROJECT ENGINEER: Gardner W. Hicks

APPROVAL RECOMMENDED: K.A. Linell, CHIEF, FDN & MAT'LS BRANCH

APPROVAL RECOMMENDED: CHIEF, PLANN & DP'TS BRANCH

CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER DAM

GEOLOGIC SECTIONS
DAM and DIKE

MAD RIVER | CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION

DATE: MAY 1960

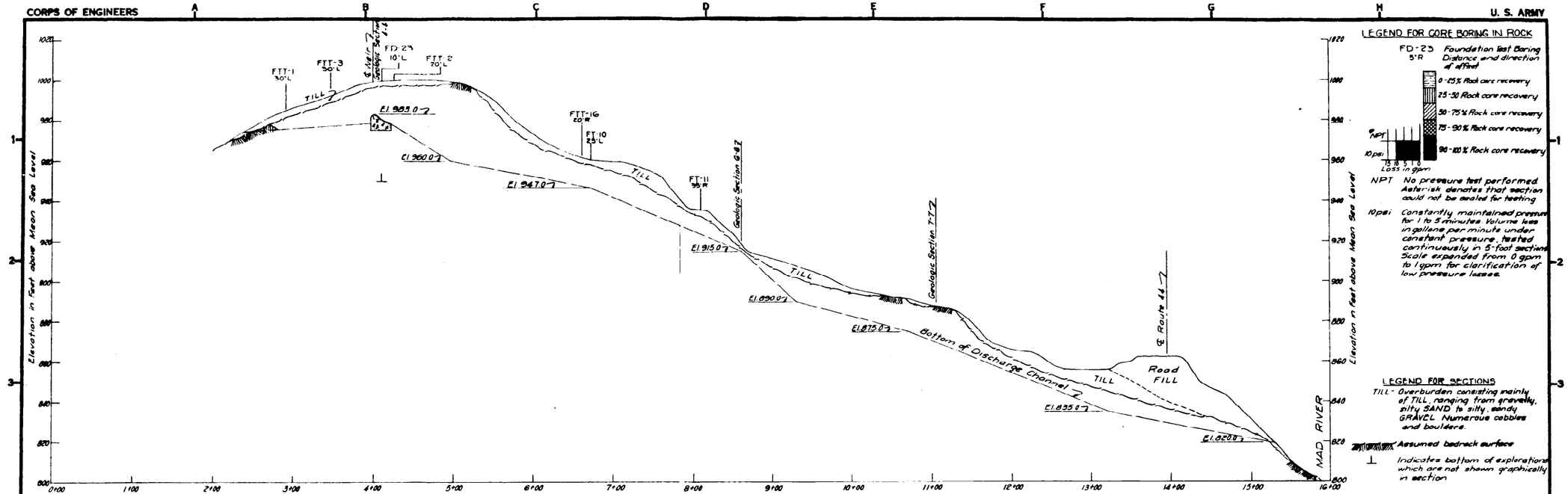
SCALE | SPEC. NO. ENG-19-016-

DRAWING NUMBER

SHEET

PLATE 2-4

CORPS OF ENGINEERS U. S. ARMY



GEOLOGIC SECTION 3-3 ALONG ℄ OF SPILLWAY
(LOOKING EAST)

LEGEND FOR CORE BORING IN ROCK

FD-23 5'R Foundation Test Boring Distance and direction of offset

0-25% Rock core recovery
25-50 Rock core recovery
50-75% Rock core recovery
75-90% Rock core recovery
90-100% Rock core recovery

NPT 10psi 10 5 1 0 Loss in gpm

NPT No pressure test performed. Asterisk denotes that section could not be sealed for testing

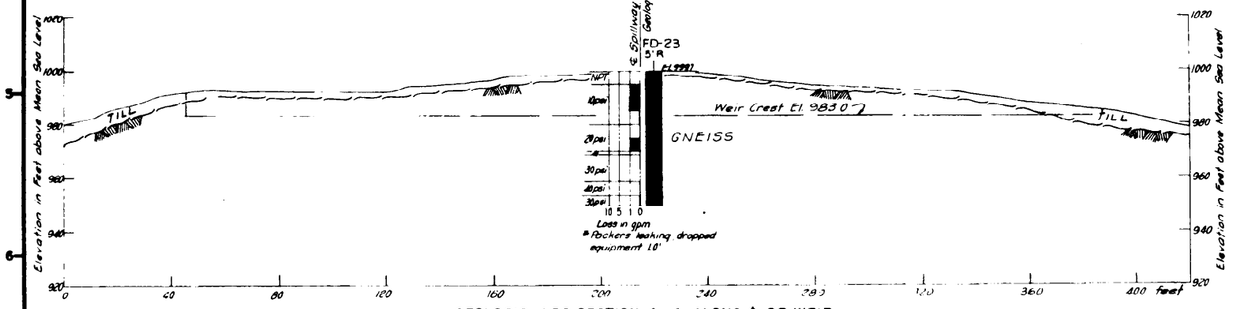
10psi Constantly maintained pressure for 1 to 5 minutes Volume loss in gallons per minute under constant pressure, tested continuously in 5-foot sections Scale expanded from 0 gpm to 1 gpm for clarification of low pressure losses

LEGEND FOR SECTIONS

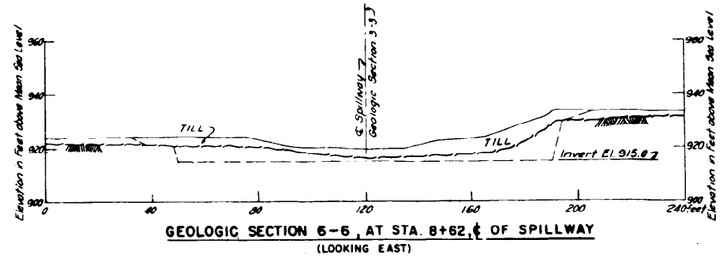
TILL- Overburden consisting mainly of TILL, ranging from gravelly, silty SAND to silty, sandy GRAVEL Numerous cobbles and boulders.

Assumed bedrock surface

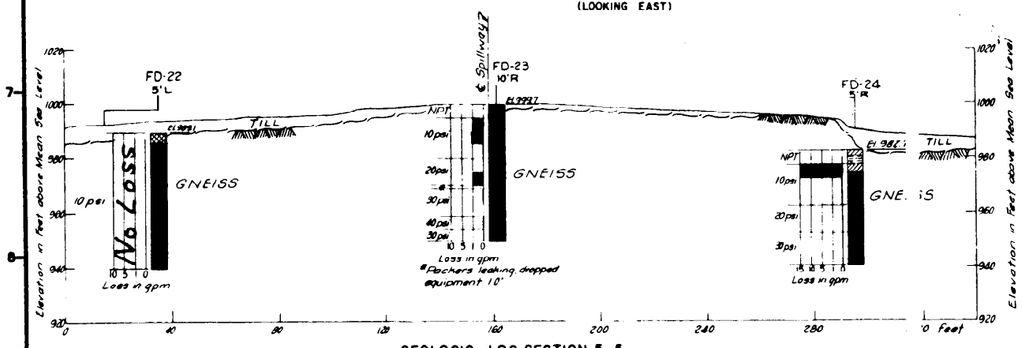
Indicates bottom of explorations which are not shown graphically in section



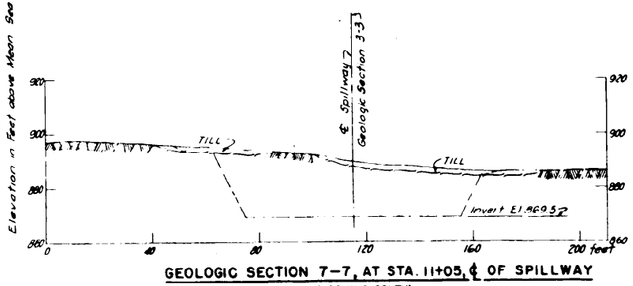
GEOLOGIC-LOG SECTION 4-4 ALONG ℄ OF WEIR
(LOOKING EAST)



GEOLOGIC SECTION 6-6, AT STA. 8+62, ℄ OF SPILLWAY
(LOOKING EAST)



GEOLOGIC-LOG SECTION 5-5
(LOOKING EAST)



GEOLOGIC SECTION 7-7, AT STA. 11+05, ℄ OF SPILLWAY
(LOOKING SOUTH)

NOTES
For Record of Foundation Explorations, see Plates 2-7, 2-8, 2-9 and 2-10
for Location of Geologic Sections, see Plate 2-2

Revision	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

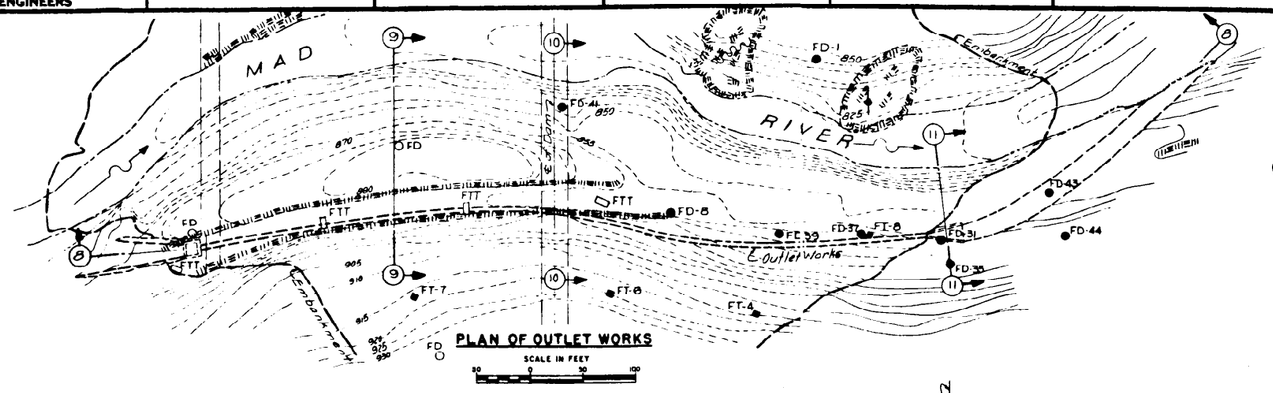
DES. BY M.A.V. | DR. BY C.B. | CK. BY R.C.S.
SUBMITTED
Head, Geology Section
PROJECT ENGINEER
APPROVAL RECOMMENDED
Chief, Fdn. & Mat'ls Branch
APPROVAL RECOMMENDED
Chief, Plans & Spec's Branch

CONNECTICUT RIVER FLOOD CONTROL
MAD RIVER DAM
GEOLOGIC SECTIONS
SPILLWAY
MAD RIVER CONNECTICUT
APPROVED DATE MAY 1960
CHIEF, ENGINEERING DIVISION

SCALE SPEC. NO. ENG-19-016-
DRAWING NUMBER
SHEET

PLATE 2-5

CORPS OF ENGINEERS — U. S. ARMY

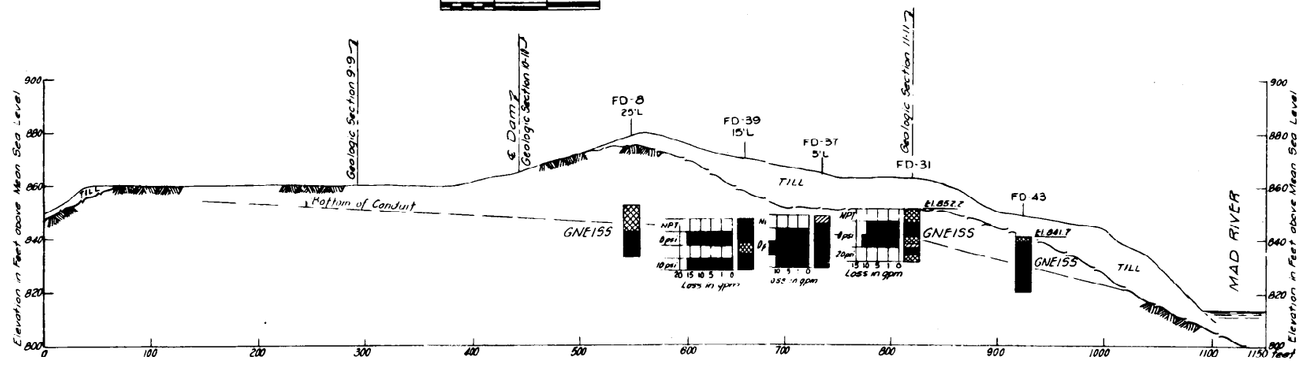


PLAN OF OUTLET WORKS

SCALE IN FEET 50 0 50 100

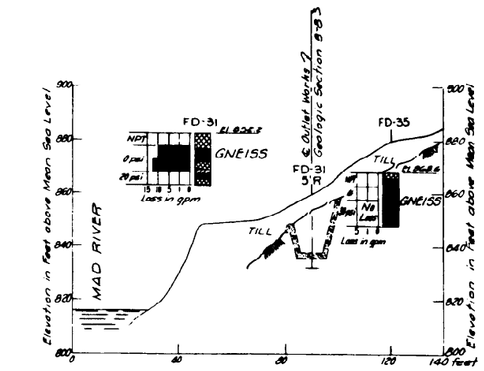
LEGEND FOR PLAN

- Foundation Test Boring
- Foundation Test Pit
- Bedrock Outcrop
- Strike and dip of foliation
- Strike and dip of vertical foliation
- Highly contorted foliation
- 9 — 9 Geologic Section
- Foundation Test Boring (in progress)
- Foundation Test Pit (in progress)
- Foundation Test Trench (in progress)



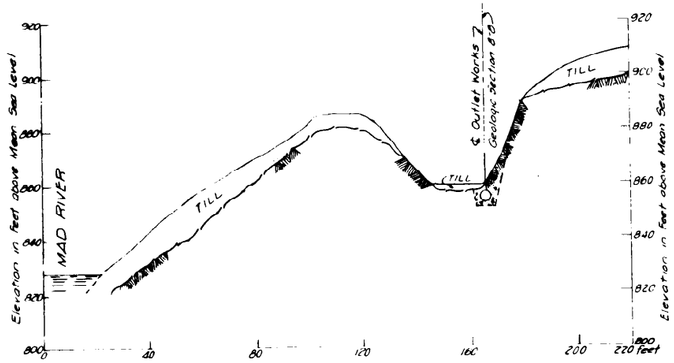
GEOLOGIC-LOG SECTION 8-8, ALONG ℄ OF OULET WORKS

(LOOKING EAST)



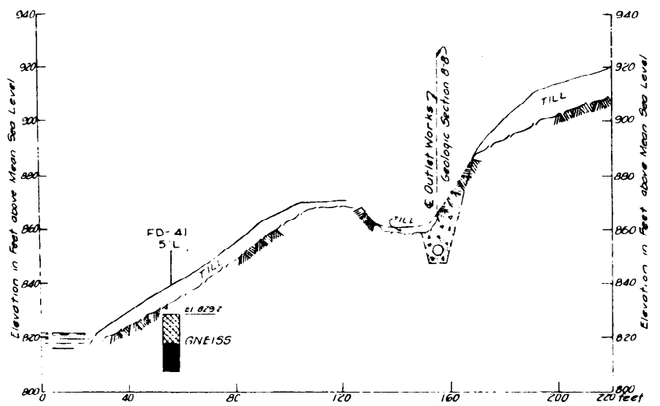
GEOLOGIC-LOG SECTION 11-11, 370' DOWNSTREAM FROM ℄ OF DAM

(LOOKING DOWNSTREAM)



GEOLOGIC-LOG SECTION 9 – 9,150' UPSTREAM FROM ℄ OF DAM

(LOOKING DOWNSTREAM)



GEOLOGIC-LOG SECTION 10-10, ALONG ℄ OF DAM

(LOOKING DOWNSTREAM)

LEGEND FOR SECTIONS

TILL - Overburden consisting mainly of TILL ranging from gravelly, silty SAND to silty, sandy GRAVEL

Assumed bedrock surface

Indicates bottom of explorations which are not shown graphically in section

NOTES

For Record of Foundation Explorations, see Plates 2-7, 2-8, 2-9 and 2-10

For Location of Geologic Sections, see Plates 2-2 and 2-6

For Legend of Core Boring in Rock, see Plate 2-5

Revision	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
H.A.V.	C.B.	R.C.G.

SUBMITTED: [signature] HEAD, GEOLOGY SECTION

RECOMMENDED: [signature]

APPROVAL RECOMMENDED: [signature] CHIEF, FDN & EARTH'S BRANCH

APPROVAL RECOMMENDED: CHIEF, PLANS & R'Y'TS BRANCH

CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER DAM

PLAN AND GEOLOGIC SECTIONS

OUTLET WORKS

MAD RIVER — CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION

DATE: MAY 1960

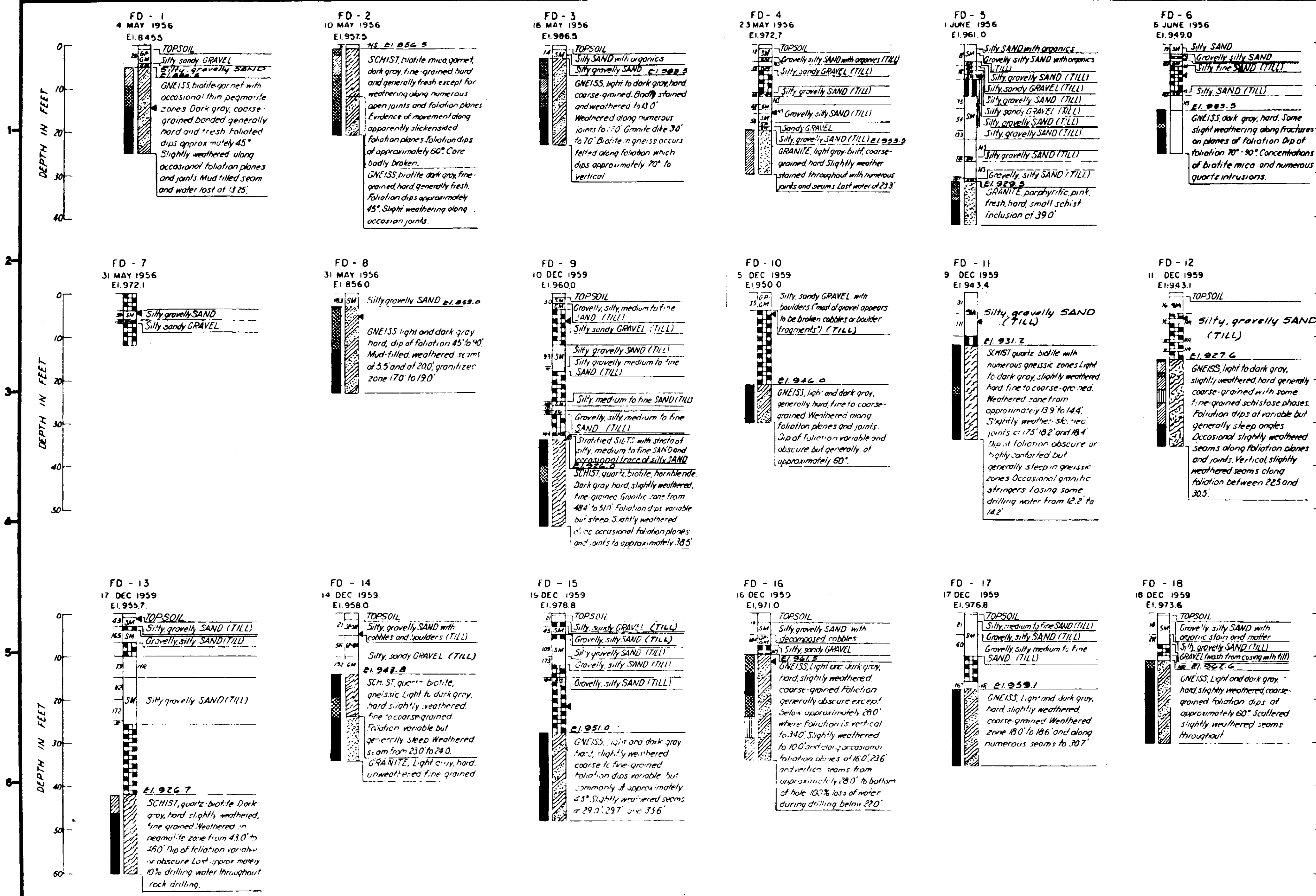
SCALE

SPEC. NO. ENG.-19-016-

DRAWING NUMBER

SHEET

PLATE 2-6


DEPTH IN FEET
FD - 1
4 MAY 1956
El. 845.5
TOPSOIL
Silty sandy GRAVEL
Silty, gravelly SAND
GNEISS, biotite-garnet with occasional thin pegmatite zones. Dark gray, coarse-grained, banded, generally hard and fresh. Foliated dips approximately 45°. Slightly weathered along occasional foliation planes and joints. Mud-filled seam and water lost at 13.25'.
FD - 2
10 MAY 1956
El. 957.5
El. 956.5
SCHIST, biotite mica garnet, dark gray, fine-grained, hard and generally fresh except for weathering along numerous open joints and foliation planes. Evidence of movement along apparently slickensided foliation planes. Foliation dips of approximately 60°. Core badly broken.
GNEISS, biotite, dark gray, fine-grained, hard, generally fresh. Foliation dips approximately 45°. Slight weathering along occasional joints.
FD - 3
16 MAY 1956
El. 986.5
TOPSOIL
Silty SAND with organics
Silty gravelly SAND El. 983.5
GNEISS, light to dark gray, hard, coarse-grained. Badly stained and weathered to 13.0'. Weathered along numerous joints to 7.0'. Granite dike 30' to 70'. Biotite in gneiss occurs felted along foliation which dips approximately 70° to vertical.
FD - 4
23 MAY 1956
El. 972.7
TOPSOIL
Gravelly silty SAND with organics (TILL)
Silty sandy GRAVEL (TILL)
Silty gravelly SAND (TILL)
Gravelly silty SAND (TILL)
Sandy GRAVEL
Silty gravelly SAND (TILL) El. 953.9
GRANITE, light gray-buff, coarse-grained, hard. Slightly weather stained throughout with numerous joints and seams. Lost water at 23.3'.
FD - 5
1 JUNE 1956
El. 961.0
Silty SAND with organics
Gravelly silty SAND with organics (TILL)
Silty gravelly SAND (TILL)
Silty sandy GRAVEL (TILL)
Silty gravelly SAND (TILL)
Silty sandy GRAVEL (TILL)
Silty gravelly SAND (TILL)
Silty gravelly SAND (TILL)
Silty gravelly SAND (TILL)
Gravelly silty SAND (TILL)
El. 929.5
GRANITE, porphyritic, pink, fresh, hard, small schist inclusion at 39.0'.
FD - 6
6 JUNE 1956
El. 949.0
Silty SAND
Gravelly silty SAND
Silty fine SAND (TILL)
Silty SAND (TILL)
El. 933.5
GNEISS, dark gray, hard. Some slight weathering along fractures on planes of foliation. Dip of foliation 70° - 90°. Concentrations of biotite mica and numerous quartz intrusions.
FD - 7
31 MAY 1956
El. 972.1
Silty gravelly SAND
Silty sandy GRAVEL
FD - 8
31 MAY 1956
El. 856.0
Silty gravelly SAND El. 853.0
GNEISS, light and dark gray, hard, dip of foliation 45° to 90°. Mud-filled, weathered seams at 5.5' and at 20.0'; granitized zone 17.0' to 19.0'.
FD - 9
10 DEC 1959
El. 960.0
TOPSOIL
Gravelly, silty, medium to fine SAND (TILL)
Silty sandy GRAVEL (TILL)
Silty gravelly SAND (TILL)
Silty gravelly medium to fine SAND (TILL)
Silty medium to fine SAND (TILL)
Gravelly, silty, medium to fine SAND (TILL)
Stratified SILTS with strata of silty medium to fine SAND and occasional trace of silty SAND
SCHIST, quartz, biotite, hornblende. Dark gray, hard, slightly weathered, fine-grained. Granitic zone from 48.4' to 51.0'. Foliation dips variable but steep. Slightly weathered along occasional foliation planes and joints to approximately 38.5'.
FD - 10
5 DEC 1959
El. 950.0
Silty, sandy GRAVEL with boulders (most of gravel appears to be broken cobbles or boulder fragments) (TILL)
El. 946.0
GNEISS, light and dark gray, generally hard, fine to coarse-grained. Weathered along foliation planes and joints. Dip of foliation variable and obscure but generally at approximately 60°.
FD - 11
9 DEC 1959
El. 943.4
Silty, gravelly SAND (TILL)
El. 931.2
SCHIST, quartz biotite with numerous gneissic zones. Light to dark gray, slightly weathered, hard, fine to coarse-grained. Weathered zone from approximately 13.9' to 14.4'. Slightly weather-stained joints at 17.5', 18.2' and 18.4'. Dip of foliation obscure or highly contorted but generally steep in gneissic zones. Occasional granitic stringers. Losing some drilling water from 12.2' to 14.2'.
FD - 12
11 DEC 1959
El. 943.1
TOPSOIL
Silty, gravelly SAND (TILL)
El. 927.6
GNEISS, light to dark gray, slightly weathered, hard, generally coarse-grained with some fine-grained schistose phases. Foliation dips at variable but generally steep angles. Occasional slightly weathered seams along foliation planes and joints. Vertical slightly weathered seams along foliation between 22.5 and 30.5'.
FD - 13
17 DEC 1959
El. 955.7
TOPSOIL
Silty gravelly SAND (TILL)
Gravelly silty SAND (TILL)
Silty gravelly SAND (TILL)
El. 926.7
SCHIST, quartz-biotite. Dark gray, hard, slightly weathered, fine grained. Weathered in pegmatite zone from 43.0' to 45.0'. Dip of foliation variable or obscure. Lost approximately 10% drilling water throughout rock drilling.
FD - 14
14 DEC 1959
El. 958.0
TOPSOIL
Silty gravelly SAND with cobbles and boulders (TILL)
Silty, sandy GRAVEL (TILL)
El. 943.8
SCHIST, quartz-biotite, gneissic. Light to dark gray, hard, slightly weathered, fine to coarse-grained. Foliation variable but generally steep. Weathered seam from 23.0 to 24.0.
GRANITE, light gray, hard, unweathered, fine grained.
FD - 15
15 DEC 1959
El. 978.8
TOPSOIL
Silty sandy GRAVEL (TILL)
Gravelly, silty SAND (TILL)
Silty gravelly SAND (TILL)
Gravelly silty SAND (TILL)
Gravelly silty SAND (TILL)
El. 951.0
GNEISS, light and dark gray, hard, slightly weathered, coarse to fine-grained. Foliation dips variable but commonly at approximately 45°. Slightly weathered seams at 29.0', 29.7' and 33.6'.
FD - 16
16 DEC 1959
El. 971.0
TOPSOIL
Silty gravelly SAND with decomposed cobbles
Silty, sandy GRAVEL
El. 961.5
GNEISS, light and dark gray, hard, slightly weathered, coarse-grained. Foliation generally obscure except below approximately 28.0' where foliation is vertical to 34.0'. Slightly weathered to 10.0' and along occasional foliation planes at 16.0', 23.6' and vertical seams from approximately 28.0' to bottom of hole. 100% loss of water during drilling below 22.0'.
FD - 17
17 DEC 1959
El. 976.8
TOPSOIL
Silty, medium to fine SAND (TILL)
Gravelly, silty SAND (TILL)
Gravelly silty medium to fine SAND (TILL)
El. 959.1
GNEISS, light and dark gray, hard, slightly weathered, coarse-grained. Weathered zone 18.0' to 18.6' and along numerous seams to 30.7'.
FD - 18
18 DEC 1959
El. 973.6
TOPSOIL
Gravelly silty SAND with organic stain and matter
Silty gravelly SAND (TILL)
GRAVEL (wash from casing with fill)
El. 962.6
GNEISS, light and dark gray, hard, slightly weathered, coarse-grained. Foliation dips at approximately 60°. Scattered slightly weathered seams throughout.

LEGEND FOR GRAPHIC LOGS

FD-16	Foundation Test Boring
(OW)	Observation well installed
16 DEC 1959	Date exploration completed
El. 971.0	Elevation of ground surface during time of exploration
	Maximum artesian head
	Subsurface water level in boring at time of exploration
	Range of subsurface water during period of exploration
	Artesian flow encountered
SP	Group letter symbol according to Unified Soil Classification System
NR	No Recovery or unsatisfactory soils samples recovered
NS	Not Sampled. Hole advanced by Core-drilling, blasting and/or wash boring due to operational difficulties
	Bottom of observation well
CD	Sampling in overburden by Core drilling method.
25	Blows per foot of penetration considered most representative for each sample drive using a 300 or 350 pound hammer with a free fall of about 18" on a 1⅞" I.D. or 2" O.D.; 2" I.D. or 2" O.D. and/or 2⅝" I.D. or 3" O.D. size sample spoon equipped with a beveled and sharpened drive shoe.
#	Blow counts not recorded or not considered representative
	Cobble or boulder (Core drilled)
	Cobbles or boulders, continuous or nested (Core-drilled and/or blasted and chopped)
	El. 961.5 Elevation of bedrock surface
	Rock symbol
	Rock core recovery 0 - 25 %
	Rock core recovery 25 - 50 %
	Rock core recovery 50 - 75 %
	Rock core recovery 75 - 90 %
	Rock core recovery 90 - 100 %
Loss in gpm (15 10 5 1 0)	
NPT	No pressure test performed. Asterisk denotes that section could not be sealed for testing
30 psi	Constantly maintained pressure from 1 to 5 minutes. Volume loss in gallons per minute under constant pressure, tested continuously in 5 foot sections. Scale expanded from 0 gpm to 1 gpm for clarification of low pressure losses

NOTES

Elevations refer to Mean Sea Level Datum.
For Location of Foundation Explorations, see Plates 2-2 and 2-3

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.A.V. — DR. BY R.A.W. — CK. BY R.C.G.

CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER DAM

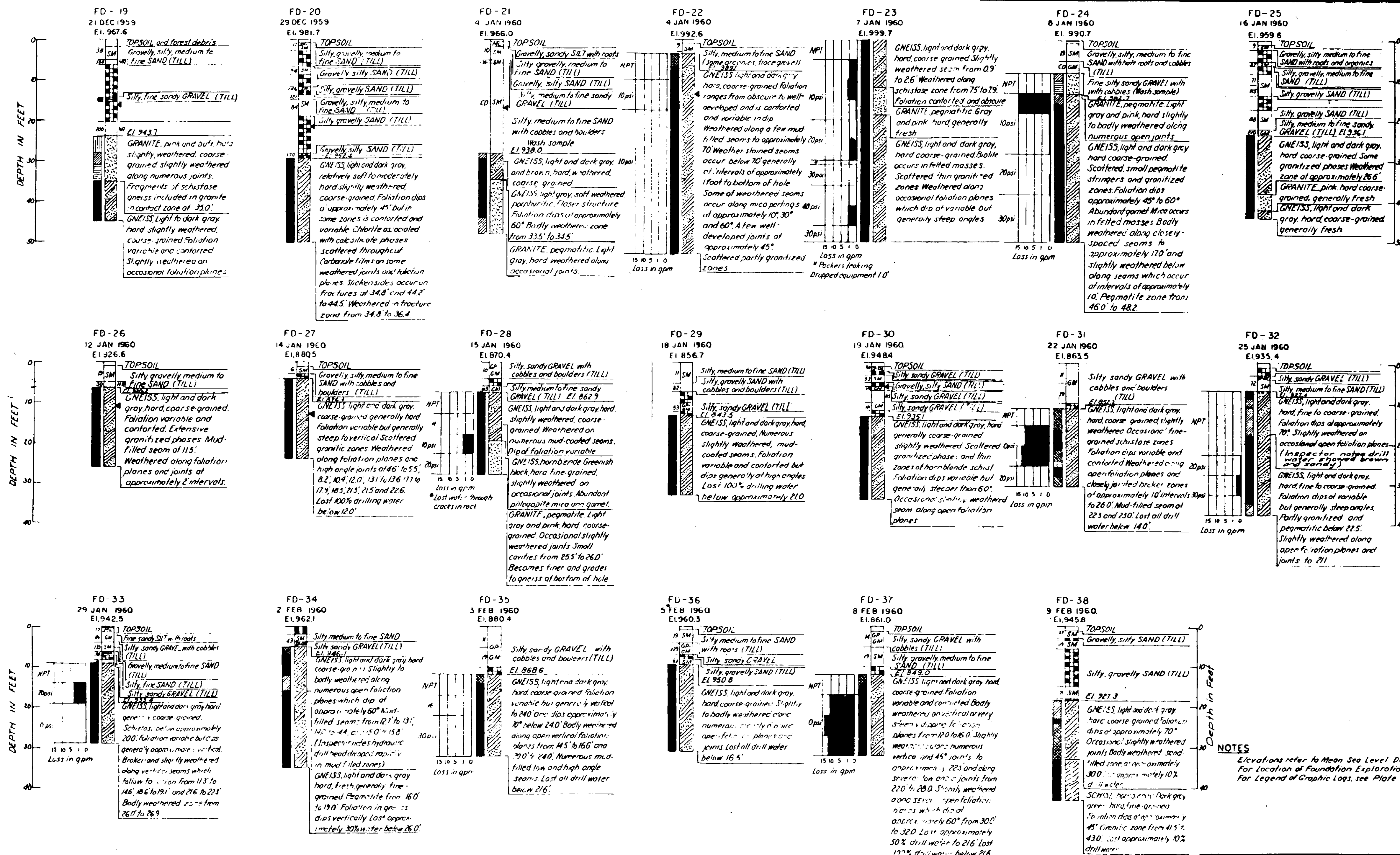
RECORD OF FOUNDATION EXPLORATIONS NO. 1

MAD RIVER — CONNECTICUT

SUBMITTED: CHIEF, GEOLOGY SECTION — CHIEF, SOILS ENGINEERING — APPROVAL RECOMMENDED: CHIEF, FDN & MAT'LS BRANCH — APPROVAL RECOMMENDED: CHIEF, PLANS & SPEC'S BRANCH — APPROVED: CHIEF, ENGINEERING DIVISION

DATE: MAY 1960

SCALE — SPEC. NO. ENG. 19-016- — DRAWING NUMBER — SHEET



NOTES

Elevations refer to Mean Sea Level Datum
For Location of Foundation Explorations, see Plates 2-2 and 2-3
For Legend of Graphic Logs, see Plate 2-7

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.A.V. | DR. BY R.A.W. | CK. BY R.C.G.

SUBMITTED: [signature] HEAD, GEOLOGY SECTION
PROJECT ENGINEER: [signature]
APPROVAL RECOMMENDED: K. A. Linell — CHIEF, FDN. & MAT'LS BRANCH
APPROVAL RECOMMENDED: CHIEF, PLANN. & P'T'G BRANCH

CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER DAM

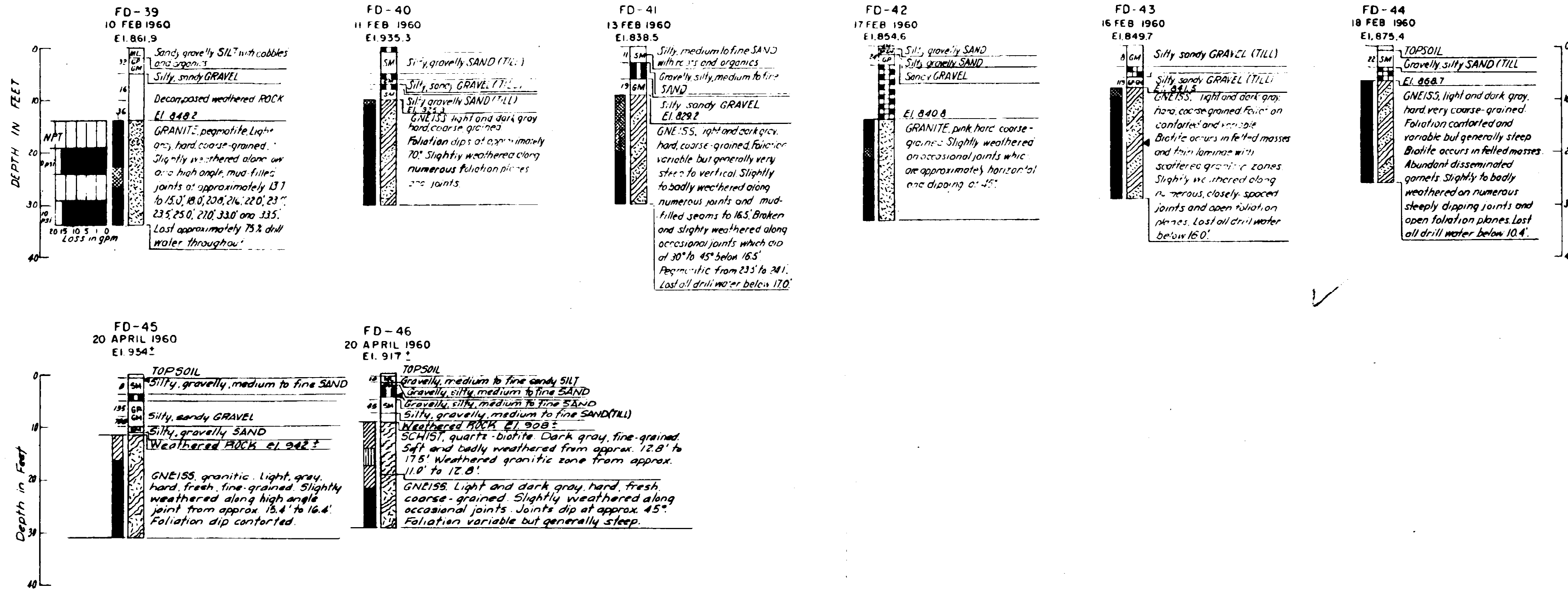
RECORD OF FOUNDATION EXPLORATIONS NO. 2

MAD RIVER — CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION — DATE: MAY 1960

SCALE — SPEC. NO. ENG-19-016-
DRAWING NUMBER
SHEET

PLATE 2-8


FD-39
10 FEB 1960
El. 861.9
DEPTH IN FEET
NPT
Loss in gpm
Sandy gravelly SILT with cobbles and organics
Silty, sandy GRAVEL
Decomposed weathered ROCK
El. 848.2
GRANITE, pegmatite. Light gray, hard, coarse-grained. Slightly weathered along one high angle, mud-filled joints at approximately 13.7 to 15.0', 18.0', 20.8', 21.6', 22.0', 23.0', 23.5', 25.0', 27.0', 33.0' and 33.5'. Lost approximately 75% drill water throughout
FD-40
11 FEB 1960
El. 935.3
Silty, gravelly SAND (TILL)
Silty, sandy GRAVEL (TILL)
Silty gravelly SAND (TILL)
GNEISS light and dark gray hard, coarse grained. Foliation dips at approximately 70°. Slightly weathered along numerous foliation planes and joints.
FD-41
13 FEB 1960
El. 838.5
Silty, medium to fine SAND with roots and organics
Gravelly silty, medium to fine SAND
Silty sandy GRAVEL
El. 829.2
GNEISS, light and dark gray, hard, coarse-grained. Foliation variable but generally very steep to vertical. Slightly to badly weathered along numerous joints and mud-filled seams to 16.5'. Broken and slighty weathered along occasional joints which dip at 30° to 45° below 16.5'. Pegmatitic from 23.5' to 24.1'. Lost all drill water below 17.0'
FD-42
17 FEB 1960
El. 854.6
Silty gravelly SAND
Silty gravelly SAND
Sandy GRAVEL
El. 840.8
GRANITE, pink, hard coarse-grained. Slightly weathered on occasional joints which are approximately horizontal and dipping at 45°.
FD-43
16 FEB 1960
El. 849.7
Silty sandy GRAVEL (TILL)
Silty sandy GRAVEL (TILL)
El. 841.5
GNEISS, light and dark gray, hard, coarse-grained. Foliation contorted and variable. Biotite occurs in felted masses and thin laminae with scattered granitic zones. Slightly weathered along numerous, closely-spaced joints and open foliation planes. Lost all drill water below 16.0'.
FD-44
18 FEB 1960
El. 875.4
TOPSOIL
Gravelly silty SAND (TILL
El. 868.7
GNEISS, light and dark gray, hard, very coarse-grained. Foliation contorted and variable but generally steep. Biotite occurs in felted masses. Abundant disseminated garnets. Slightly to badly weathered on numerous steeply dipping joints and open foliation planes. Lost all drill water below 10.4'.
Depth in Feet
FD-45
20 APRIL 1960
El. 954±
Depth in Feet
TOPSOIL
Silty, gravelly, medium to fine SAND
Silty, sandy GRAVEL
Silty, gravelly SAND
Weathered ROCK El. 942±
GNEISS, granitic. Light, gray, hard, fresh, fine-grained. Slightly weathered along high angle joint from approx. 13.4' to 16.4'. Foliation dip contorted.
FD-46
20 APRIL 1960
El. 917±
TOPSOIL
Gravelly, medium to fine sandy SILT
Gravelly, silty, medium to fine SAND
Gravelly, silty, medium to fine SAND
Silty, gravelly, medium to fine SAND (TILL)
Weathered ROCK El. 908±
SCHIST, quartz-biotite. Dark gray, fine-grained. Soft and badly weathered from approx. 12.8' to 17.5'. Weathered granitic zone from approx. 11.0' to 12.8'.
GNEISS. Light and dark gray, hard, fresh, coarse-grained. Slightly weathered along occasional joints. Joints dip at approx. 45°. Foliation variable but generally steep.

NOTES

Elevations refer to Mean Sea Level Datum
For Location of Foundation Explorations, see Plates 2-2 and 2-3
For Legend of Graphic Logs, see Plate 2-7

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.A.V. | DR. BY R.A.W. | CK. BY R.C.G.

SUBMITTED: HEAD, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED: K. A. Zenell, CHIEF, FDN. & MAT'LS BRANCH
APPROVAL RECOMMENDED: CHIEF, PL. ANN. & RPTS BRANCH

CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER DAM

RECORD OF FOUNDATION EXPLORATIONS NO. 3

MAD RIVER — CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION — DATE MAY 1960

SCALE — SPEC. NO. ENG-19-016-

DRAWING NUMBER

SHEET

CORPS OF ENGINEERS — U. S. ARMY

DEPTH IN FEET (0–10)

FT 1
26 NOV 1959
El. 994.6
SM — TOPSOIL and forest litter
Compact gravelly, silty, medium to fine SAND with organic matter
Pit Dimensions 5' x 4' x 4.5'
Cobbles and Boulders
4" - 6" 32
6" - 12" 7
Over 12" 2

FT-2
29 FEB 1960
El. 931.6
SM — TOPSOIL and forest litter
Compact silty gravelly SAND with cobbles
Pit Dimensions 6' x 4' x 6'
Cobbles and Boulders
4" - 6" 56
6" - 12" 15
Over 12 2

FT-3
29 FEB 1960
El. 960.4
SM — TOPSOIL and forest litter
Compact silty gravelly SAND with cobbles and hair roots to 2.5'
Pit Dimensions 4' x 4' x 5'
Cobbles and Boulders
4" - 6" 30
6" - 12" 18
Over 12" 5

FT 4
29 FEB 1960
El. 906.6
SM — TOPSOIL and forest litter
Compact gravelly silty SAND with cobbles to refusal
Pit Dimensions 7' x 3' x 3.8
Cobbles and Boulders
4" - 6" 25
6" - 12" 6
Over 12" 2

FT-5
29 FEB 1960
El. 944.5
SM — TOPSOIL and forest litter
GP-GM — Medium compact, silty, gravelly SAND with cobbles and organics
Very compact, silty, sandy GRAVEL with cobbles to bedrock
Pit Dimensions 4' x 5' x 5.6
Cobbles and Boulders
4" - 6" 75
6" - 12" 40
Over 12" 7

FT-6
1 MAR 1960
El. 913.9
ML — TOPSOIL and forest litter
GM — Medium compact, gravelly, medium to fine sandy SILT with organics
Compact, silty, sandy GRAVEL
Many boulders
(0–10)
Pit Dimensions 5' x 5' x 6'
Cobbles and Boulders
4" - 6" 130
6" - 12" 65
Over 12" 8

LEGEND FOR GRAPHIC LOGS

FT	Foundation Test Pit
FTT	Foundation Test Trench
1 MAR. 1960	Date Exploration Completed
El 923.8	Elevation of ground surface during time of exploration.
SM	Group letter symbol according to Unified Soil Classification System
◄	Subsurface water level at time of exploration
/////	Apparent bedrock

FT-7
29 FEB 1960
El. 913.5
SM — TOPSOIL and forest litter
GM — Loose, gravelly, silty, medium to fine SAND with cobbles and roots
Compact, silty, sandy GRAVEL with cobbles
Pit Dimensions 5' x 5' x 6'
Cobbles and Boulders
4" - 6" 36
6" - 12" 12
Over 12" 3

FT-8
29 FEB 1960
El. 960.9
SM — TOPSOIL and forest litter
Compact, silty, gravelly SAND (Nested boulders and cobbles 0.9' to 7.8')
Pit Dimensions 10' x 5' x 7.8'
Cobbles and Boulders
4" - 6" 200
6" - 12" 75
Over 12" 22 (averaging 24")

FT-9
15 APR 1960
El. 956±
ML — TOPSOIL and forest litter
SM — Loose, medium to fine sandy SILT (Trace of gravel with roots)
Compact silty gravelly fine SAND (TILL)
Pit Dimensions 4.0' x 10.0' x 5.3'
Cobbles and Boulders
4" - 6" 82
6" - 12" 4
Over 12" 3

FT-10
20 APR 1960
El. 961±
ML — TOPSOIL and forest litter
SM — Medium compact, medium to fine sandy SILT with roots and cobbles
Medium compact, silty, gravelly medium to fine SAND with cobbles and boulders
Pit Dimensions 2.3' x 6.2'
Cobbles and Boulders
4" - 6" 43
6" - 18" 32
Over 18" 7

FT-11
20 APR 1960
El. 937±
ML — TOPSOIL and forest litter
SM — Medium compact, gravelly, medium to fine sandy SILT with roots and cobbles
Medium compact, silty, gravelly SAND with cobbles and boulders
Pit Dimensions 3.4' x 9.6'
Cobbles and Boulders
4" - 6" 19
6" - 18" 11
Over 18" 1

DEPTH IN FEET (0–10)

FTT-1
30 NOV 1959
El. 992.5
TOPSOIL and moss
Trench Dimensions 10' x 3' x 0.3

FTT 2
7 DEC 1959
El. 999.4
SM — TOPSOIL and forest litter
Compact, gravelly silty SAND with roots and organic matter
Trench Dimensions 10' x 3' x 2.6'
Cobbles and Boulders
4" - 6" 20
6" - 12" 4
Over 12" 4

FTT-3
8 DEC 1959
El. 993.0
SM — TOPSOIL and forest litter
Compact silty, medium to fine SAND with roots and organics
Trench Dimensions (Not recorded)

FTT-4
8 DEC 1959
El. 994.4
SM — TOPSOIL and forest litter
Compact, silty, gravelly SAND
Trench Dimensions 9' x 3' x 1.2'
Cobbles and boulders
4" - 6" 9
Over 6" 0

FTT-5
9 DEC 1959
El. 991.3
ML — TOPSOIL and forest litter
GM — Moderately compact, sandy SILT with roots
Compact, silty, silty sandy GRAVEL (TILL)
Trench Dimensions 98' x 3' x 3.2
Cobbles and Boulders
4" - 6" 19
6" - 12" 5
Over - 12" 1

FTT-6
10 DEC 1959
El. 958.4
SM — TOPSOIL and forest litter
Compact, silty gravelly SAND (TILL)
(0–10)
Trench dimensions 9' x 3' x 6'
Cobbles and Boulders
4" - 6" 52
6" - 12" 15
Over 12" 2

DEPTH IN FEET (0–10)

FTT 7
10 DEC 1959
El. 937.8
SM — TOPSOIL and forest litter
Moderately compact silty SAND with roots
Compact, gravelly SAND (TILL)
Trench Dimensions 9' x 3' x 3.8
Cobbles and Boulders
4" - 6 23"
6" - 12" 5"
Over - 12" 0"

FTT 8
11 DEC 1959
El. 966.1
ML — TOPSOIL and forest litter
Moderately compact sandy SILT with roots and organics
Trench Dimensions 3.5' x 11.0' x 1.7'

FTT-9
4 DEC 1959
El. 918.9
SM — TOPSOIL and forest litter
Compact silty gravelly SAND (TILL)
Trench Dimensions 9' x 3' x 6'
Cobbles and Boulders
4" - 6" 46
6" - 12" 16
Over 12" 2

FTT-10
3 DEC 1959
El. 903.5
SM — TOPSOIL and forest litter
Compact gravelly silty SAND (TILL)
Trench Dimensions 9' x 3' x 3.3'
Cobbles and Boulders
4" - 6" - 19
6" - 12" 0
Over 12" 0

FTT-11
2 DEC 1959
El. 911.6
Forest litter and moss
Trench Dimensions 10' x 3' x 0.3'

FTT-12
2 DEC 1959
El. 916.8
SM — TOPSOIL and forest litter
Compact, silty, gravelly SAND
(0–10)
Trench Dimensions 9' x 3' x 5.6'
Cobbles and Boulders
4" - 6" 27
6" - 18" 3
Over 18" 1

NOTES
Elevations refer to Mean Sea Level Datum
For Location of Foundation Explorations, see Plates 2-2 and 2-3

DEPTH IN FEET (0–10)

FTT 13
1 DEC 1959
El. 889.9
Forest litter
Trench Dimensions 15' x 4' x 0.3

FTT-14
1 DEC 1959
El. 901.3
GM — TOPSOIL and Forest litter
Compact, silty, sandy GRAVEL (TILL)
Trench Dimensions 9' x 3' x 3.1'
Cobbles and Boulders
4" 6" 28
6" 18" 5
Over 18" 0

FTT-15
30 NOV 1959
El. 880.8
GP-GM — TOPSOIL and forest litter
Compact, silty, sandy GRAVEL (TILL)
Trench dimensions (Not recorded)
Cobbles and boulders
4" - 6" 21
6" - 18" 5
Over - 18" 0

FTT-16
4 APR 1960
El. 962±
ML — TOPSOIL and forest litter
SM — Loose, medium to fine sandy SILT with wood fragments and trace of gravel
Loose, silty, medium to fine SAND
Compact, silty, gravelly, medium to fine SAND (TILL)
Trench dimensions 3' x 25' x 5.0'
Cobbles and Boulders
4" - 6" 2
6" - 12" 2
Over 12" 0

FTT-17
13 APR 1960
El. 955±
ML — TOPSOIL and forest litter
SM — Loose medium to fine sandy SILT with trace of gravel
Compact silty gravelly medium to fine SAND (TILL)
Trench Dimensions 15' x 3' x 9.6'
Cobbles and Boulders
4" - 6" 12
6" - 12" 1
Over 12" 0

FTT-18
13 APR 1960
El. 966±
ML — TOPSOIL and forest litter
SM — Loose, medium to fine sandy SILT with gravel and roots
Compact silty, gravelly medium to fine SAND (TILL)
(0–10)
Trench Dimensions 12' x 4' x 8.5'
Cobbles and Boulders
4" - 6" 14
6" - 12" 2
Over 12" 0

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.A.V. | DR. BY R.A.W. | CK. BY R.C.Q.
SUBMITTED: R.B. [signature], HEAD, GEOLOGY SECTION
PROJECT ENGINEER: [signature]
APPROVAL RECOMMENDED: K.A. [signature], CHIEF, FDN. & MAT'LS BRANCH
APPROVAL RECOMMENDED: CHIEF, PLANN. & RPTS BRANCH

CONNECTICUT RIVER FLOOD CONTROL
MAD RIVER DAM
RECORD OF FOUNDATION EXPLORATIONS NO. 4
MAD RIVER — CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION
DATE: MAY 1960
SCALE
SPEC. NO. ENG-19-016-
DRAWING NUMBER
SHEET

PLATE 2—10

CORPS OF ENGINEERS — U. S. ARMY

FTT-19
14 APRIL 1960
El 970±

Depth in Feet: 0 – 10

- ML — TOPSOIL and forest debris
- SM — Loose, gravelly medium to fine sandy SILT
- Silty gravelly medium to fine SAND (TILL)

Trench Dimensions 22'×3'×7.6'

Cobbles and Boulders

4" —	6"	18
6" —	12"	3
Over	12"	0

FTT 20
15 APRIL 1960
El 970±

- ML — TOPSOIL and forest litter
- GP — Loose gravelly medium to fine sandy SILT
- GM — Compact silty gravelly SAND

Trench Dimensions 14'×3'×8.5'

Cobbles and Boulders

4" —	6"	24
6" —	12"	3
Over	12"	0

FTT-21
20 APRIL 1960
El 980±

- ML — TOPSOIL and forest debris
- SM — Medium compact, medium to fine sandy SILT with roots and cobbles
- Compact, silty, gravelly medium to fine SAND with cobbles and boulders

Trench Dimensions 8.7'×2.2'×5.3'

Cobbles and Boulders

4" —	6"	23
6" —	18"	11
Over	18"	2

FTT-22
2 APRIL 1960
El 984±

- ML — TOPSOIL and forest debris
- SM — Medium compact, gravelly, medium to fine sandy SILT with roots and cobbles
- Medium compact, silty, medium to fine SAND with cobbles and boulders

Trench Dimensions 2.1'×8.7'×8.2'

Cobbles and Boulders

4" —	6"	20
6" —	18"	9
Over	18"	0

FTT-23
20 APRIL 1960
El 992±

- ML — TOPSOIL and forest debris
- Medium compact, gravelly, medium to fine sandy SILT with roots and cobbles

Trench Dimensions 2.3'×9.9'×3.7'

Cobbles and Boulders

4" —	6"	23
6" —	18"	14
Over	18"	0

NOTES
Elevations refer to Mean Sea Level Datum.
For Location of Foundation Explorations, see Plates 2-2 and 2-3.
For Legend of Graphic Logs, see Plate 2-10.

REVISION | DATE | DESCRIPTION | BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.A.V. — DR. BY R.D.B. — CK. BY R.C.G.
SUBMITTED — HEAD GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED — CHIEF, FDN & MAT'LS BRANCH
APPROVAL RECOMMENDED — CHIEF, PLANN & SP'TS BRANCH

CONNECTICUT RIVER FLOOD CONTROL

MAD RIVER DAM

RECORD OF FOUNDATION EXPLORATIONS NO. 5

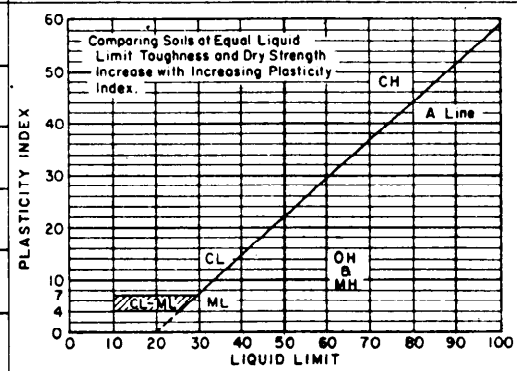
MAD RIVER — CONNECTICUT

APPROVED — CHIEF, ENGINEERING DIVISION — DATE MAY 1960

SCALE — SPEC. NO. ENG-19-016-
DRAWING NUMBER
SHEET

UNIFIED SOIL CLASSIFICATION
(Including Identification and Description)

Major Divisions			Group Symbols	Typical Names	Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weight).			Laboratory Classification Criteria
Coarse-grained Soils More than half of material is larger than No 200 sieve size.	Gravels More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size)	Clean Gravels (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.			Determine percentages of gravel and sand from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows: Less than 5% GW, GP, SW, SP. More than 12% GM, GC, SM, SC. 5% to 12% Borderline cases requiring use of dual symbols. $C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			GP	Poorly graded gravels, or gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.			Not meeting all gradation requirements for GW
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixture.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).			Atterberg limits below "A" line with PI less than 4 / Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixture.	Plastic fines (for identification procedures see CL below).			Atterberg limits above "A" line with PI greater than 7
	Sands More than half of coarse fraction is smaller than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size)	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.			$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			SP	Poorly graded sands or gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.			Not meeting all gradation requirements for SW
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).			Atterberg limits above "A" line or PI less than 4 / Limits plotting in hatched zone with PI between 4 and 7 are borderline cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).			Atterberg limits above "A" line with PI greater than 7
					Identification Procedures on Fraction Smaller than No. 40 Sieve Size			
					Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL)	
Fine-grained Soils More than half of material is smaller than No. 200 sieve size The No. 200 sieve size is about the smallest	Silts and Clays Liquid limit is less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None	
			CL	Inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium	
			OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight	
	Silts and Clays Liquid limit is greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium	
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High	
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to Medium	
Highly Organic Soils			PT	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			



PLASTICITY CHART
For laboratory classification of fine-grained soils

(1) Boundry classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder.
(2) All sieve sizes on this chart are U. S. standard.

NOTE

For further information on Unified Soil Classification, refer to "The Unified Soil Classification System," Volumes I and 2, Technical Memorandum No. 3-357, published by U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. File copies may be examined at Headquarters, U. S. Army Engineer Division, New England, 424 Trapelo Road, Waltham, Massachusetts., Building 141, Foundation and Materials Branch.

Adopted by Corps of Engineers and Bureau of Reclamation, January 1952

PLATE 2 - 12